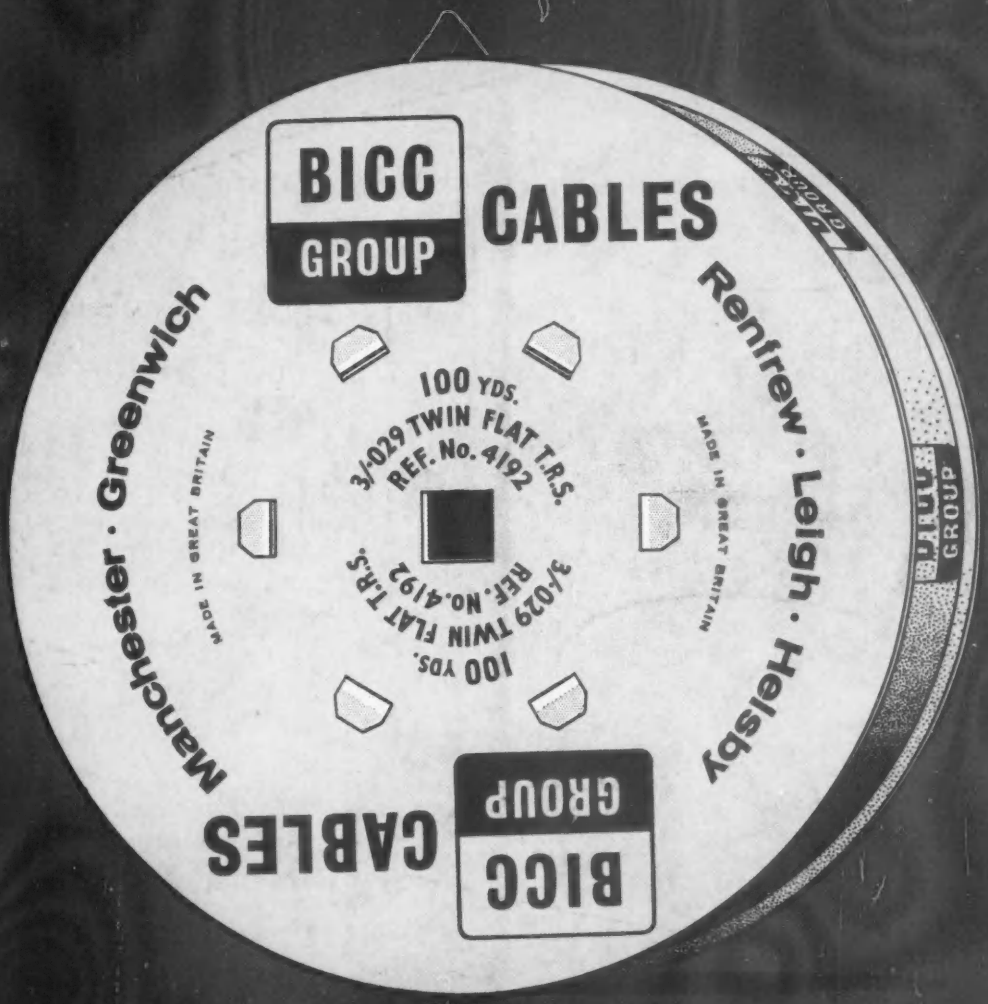
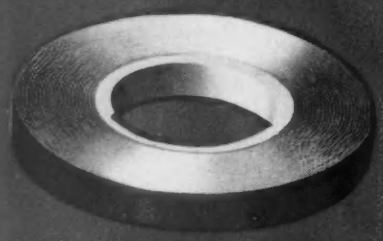
ELECTRICAL TIMES



The sign of a Nation-Wide Service

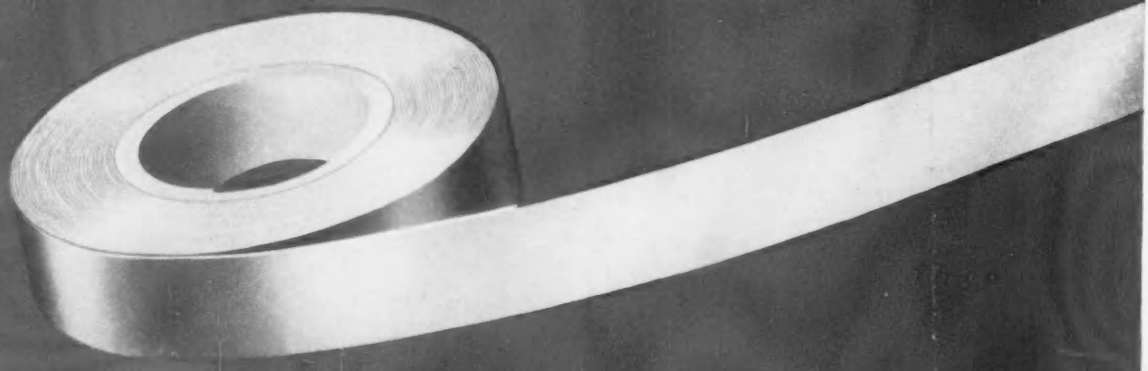
Wide Tapes · Narrow Tapes

Thick Tapes · Thin Tapes



Micanite & Samicanite* TAPES With various reinforcing materials and bonding agents.

Empire Varnished TAPES In various combinations of base material and varnish.



M&I make all sorts of Electrical Insulating Tapes

m and i the electrical insulation people

THE MICANITE & INSULATORS CO., LTD.,

Empire Works, Blackhorse Lane, Walthamstow, London, E.17

TELEPHONE: LARKWOOD 5000. TELEGRAMS: MYTOLITE, LONDON. TELEX. TELEX 22183

*MICANITE is the name for electrical insulating material manufactured from "SAMICA" mica paper and supplied in Great Britain, Northern Ireland, Eire and most of the British Commonwealth through THE Micanite & Insulators Co., Ltd., the sole licensee for these territories. ®"SAMICA" is a registered trade mark.

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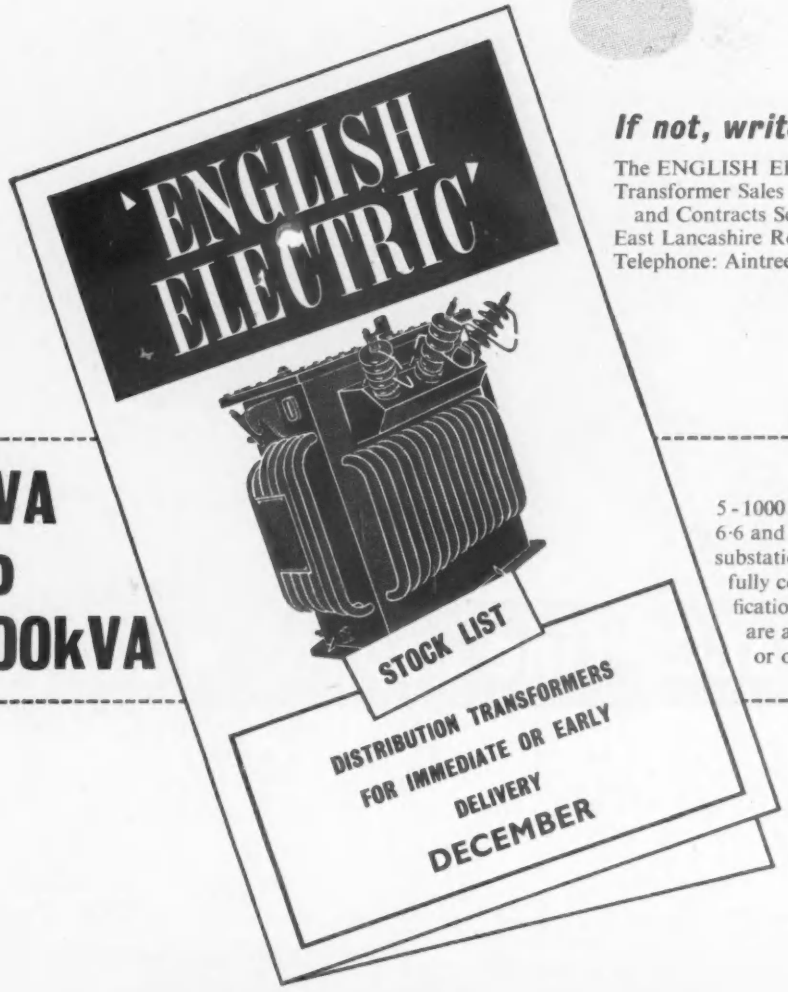

If not, write to:

The ENGLISH ELECTRIC Co. Ltd.
Transformer Sales
and Contracts Section,
East Lancashire Road, Liverpool 10.
Telephone: Aintree 3641

5kVA to 1000kVA

5 - 1000 kVA
6·6 and 11 kV pole and substation type transformers, fully complying with Specification B.E.B.S.T.1 (1958) are available EX STOCK or on short delivery.

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THE ENGLISH ELECTRIC COMPANY LIMITED, ENGLISH ELECTRIC HOUSE, STRAND, LONDON, W.C.2
WORKS: STAFFORD · PRESTON · RUGBY · BRADFORD · LIVERPOOL · ACCRINGTON

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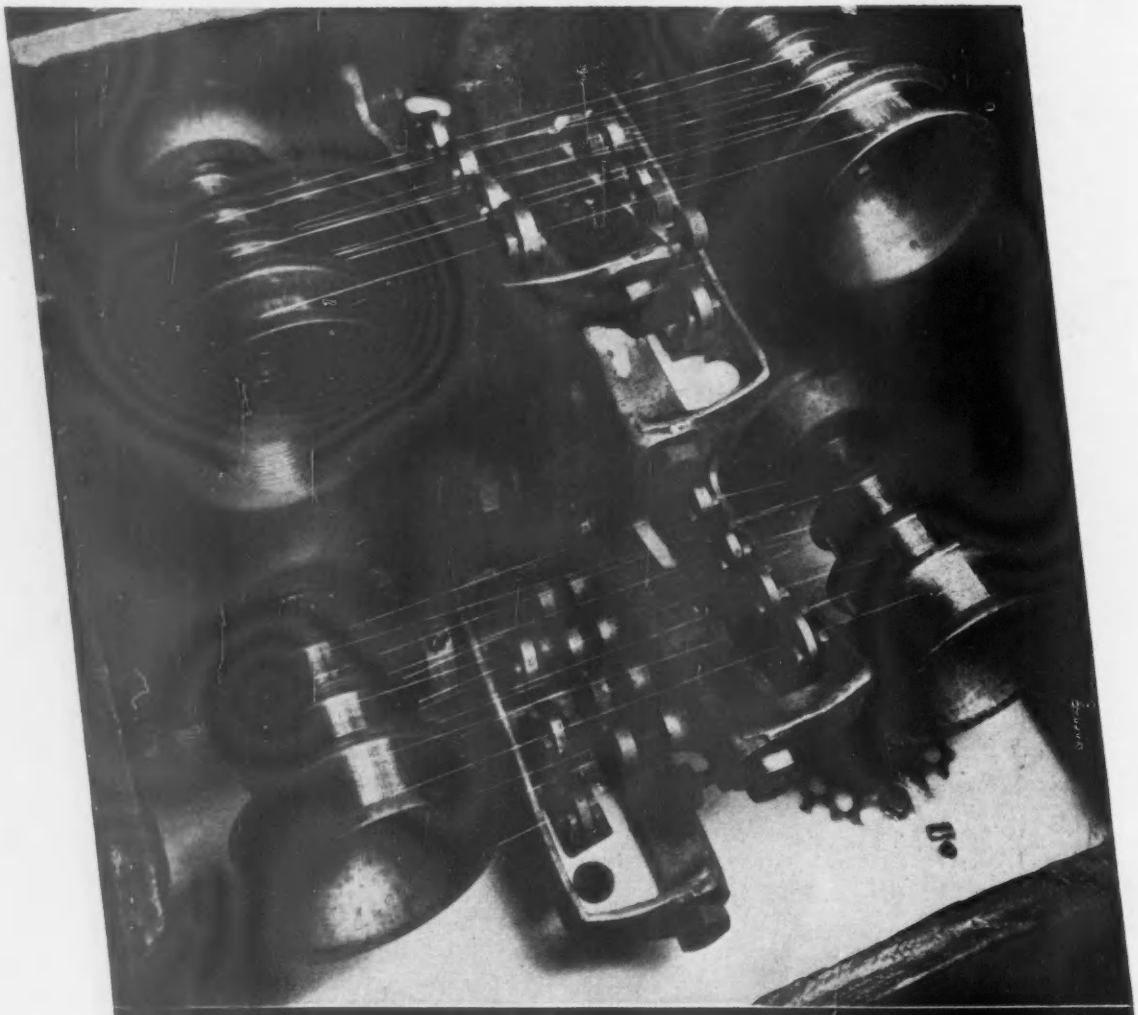


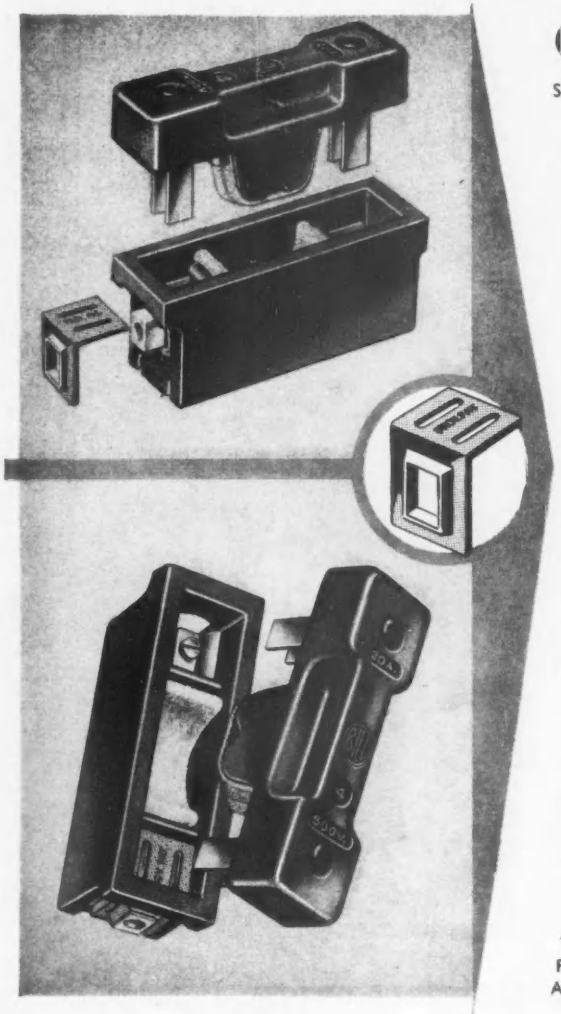
ANACOS fine copper wires...

. . . . are drawn through diamond dies which reduce the diameter repeatedly until the desired size is reached — they have a high reputation throughout the Electrical Industry for their quality and uniformity

FREDERICK SMITH & COMPANY ANACONDA WORKS : SALFORD 3 : LANCS

You cannot buy better gear

SAFETY BILL SHIELDS



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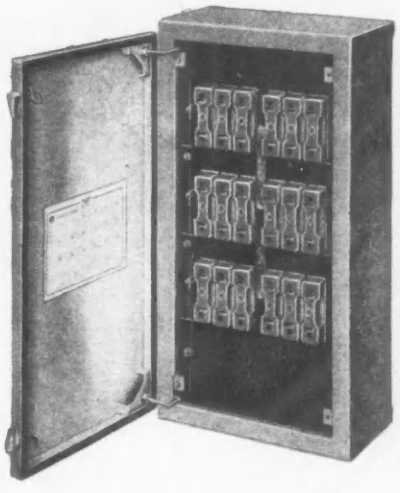
FUSEBOARDS ARE AVAILABLE WITH NO PRICE INCREASE IN ALL SIZES OF 15/20 AMP. AND 30 AMP. RATINGS.



THE INTRODUCTION OF PROTECTIVE SHIELDS FITTED OVER THE LIVE CONTACT ENDS IN THE FUSE BASES GIVES ADEQUATE PROTECTION AGAINST ACCIDENTAL CONTACT WHEN THE FUSE CARRIERS ARE WITHDRAWN.

THE SHIELDS ARE STRONG DURABLE MOULDED NYLON AND FORM AN INTEGRAL PART OF THE BUSBAR FUSE CONTACT ASSEMBLY AND CANNOT ACCIDENTALLY BECOME DETACHED.

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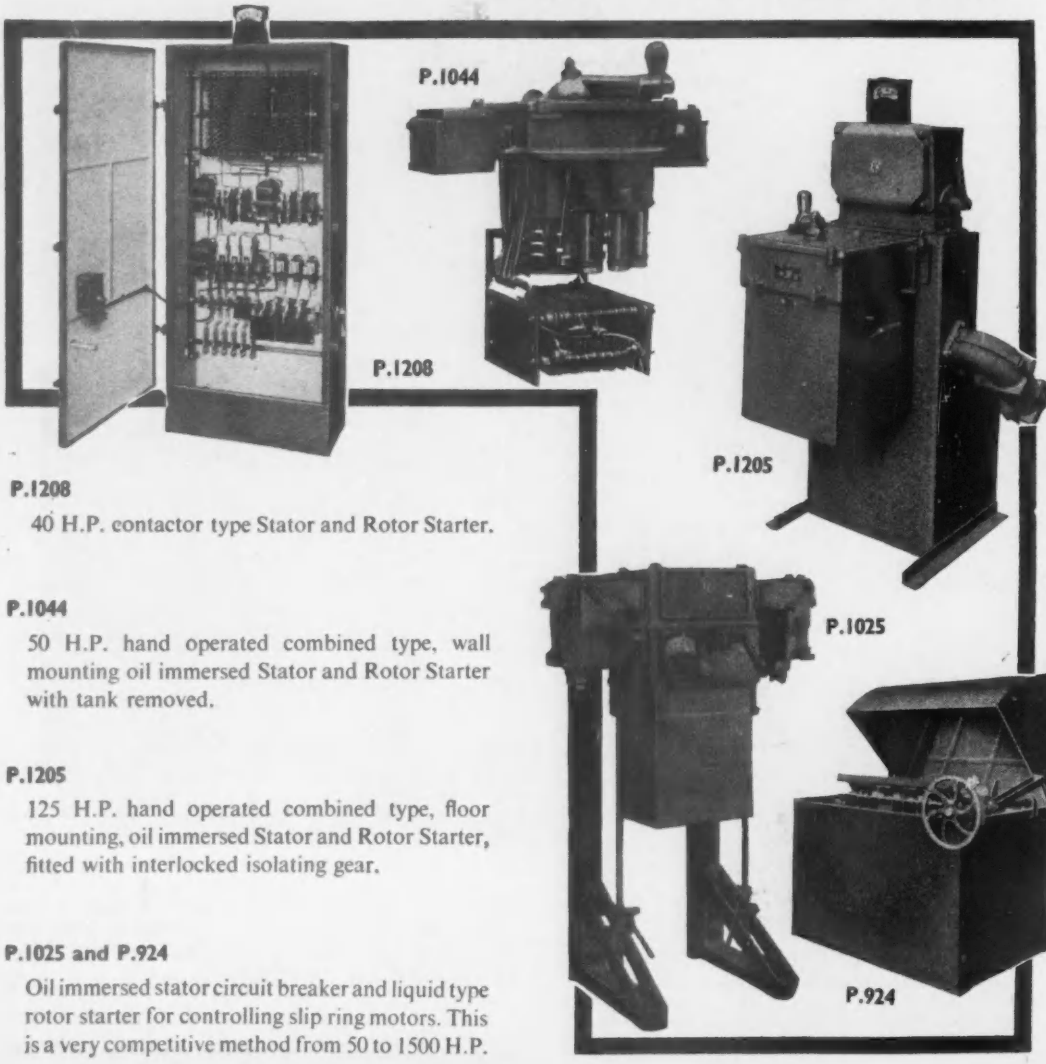
"ERSKINE HEAP"

SLIP RING MOTOR STARTERS

We manufacture all types of Stator and Rotor Starters for controlling Slip Ring Motors, both of the hand operated, oil immersed or liquid starter type and also the contactor type. Typical examples are illustrated.

SEND US YOUR ENQUIRIES



P.1208

40 H.P. contactor type Stator and Rotor Starter.

P.1044

50 H.P. hand operated combined type, wall mounting oil immersed Stator and Rotor Starter with tank removed.

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125 H.P. hand operated combined type, floor mounting, oil immersed Stator and Rotor Starter, fitted with interlocked isolating gear.

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Oil immersed stator circuit breaker and liquid type rotor starter for controlling slip ring motors. This is a very competitive method from 50 to 1500 H.P.

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717

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100% SAFER
and that's not all!
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Mouldings for the Wolf Safetymaster are by Minerva Mouldings Ltd., using B.R.P. and B.I.P. compounds.
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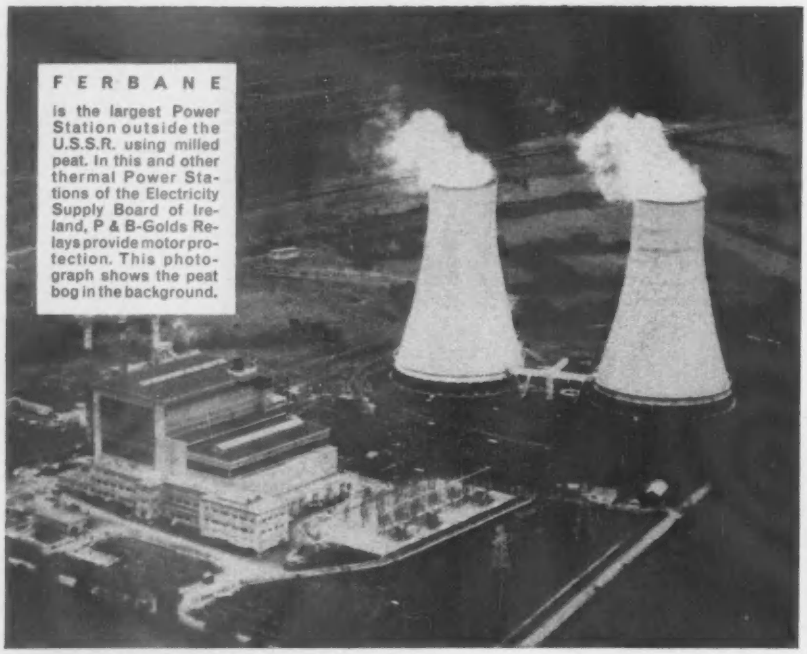

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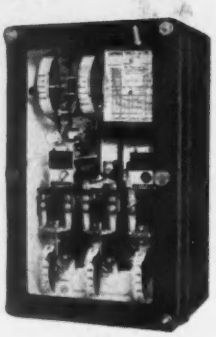
is the largest Power Station outside the U.S.S.R. using milled peat. In this and other thermal Power Stations of the Electricity Supply Board of Ireland, P & B-Golds Relays provide motor protection. This photograph shows the peat bog in the background.

BORD SOLATHAIR AN LEICTREACHAIS choose P & B Golds Relays

P & B Relays give full protection for motors with any starting periods or currents under extremes of ambient temperature.
P & B Golds Relays protect against phase failure, overload, short circuit or earth fault. P & B Stalling Relays give complete protection against stalling under all conditions. Send for current literature.



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PROTECTION RELAYS

THE P & B ENGINEERING CO. LTD
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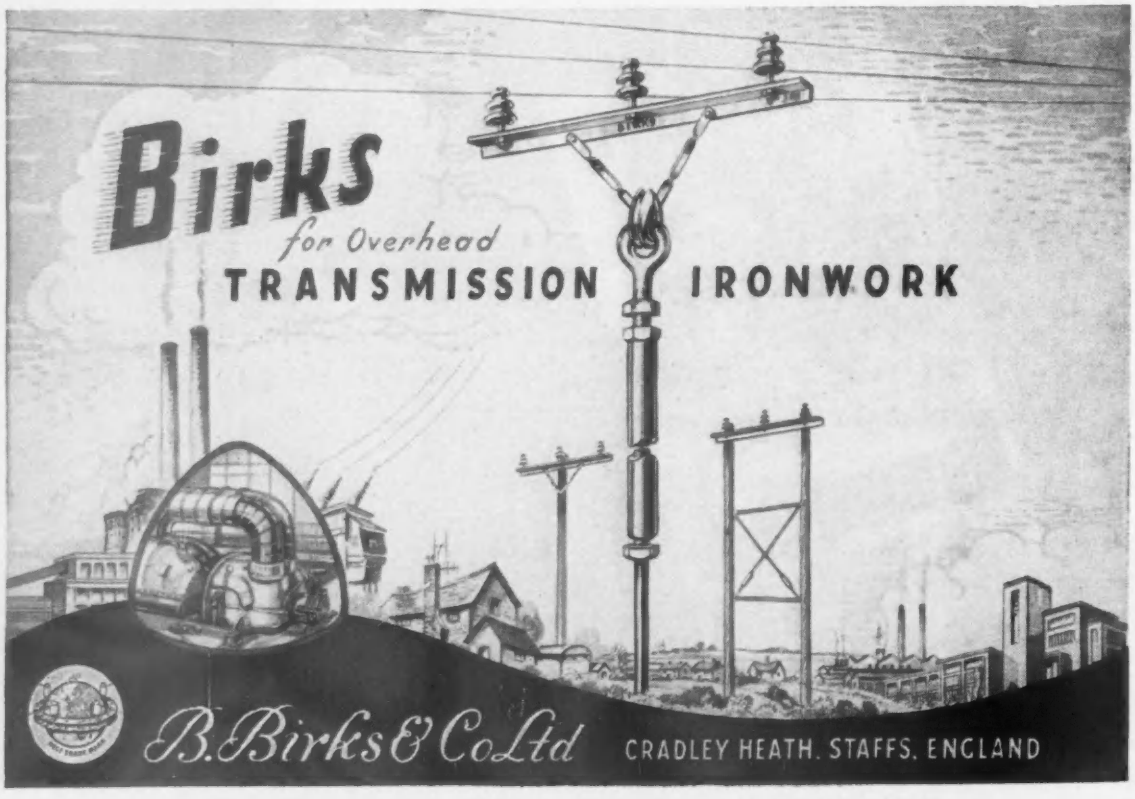

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Connolly's fine enamelled winding wires make a big contribution to increased reliability and speedier production. The latest Connollys publications, covering the complete range of winding wires, provide a valuable source of information for the designer and coil winder.

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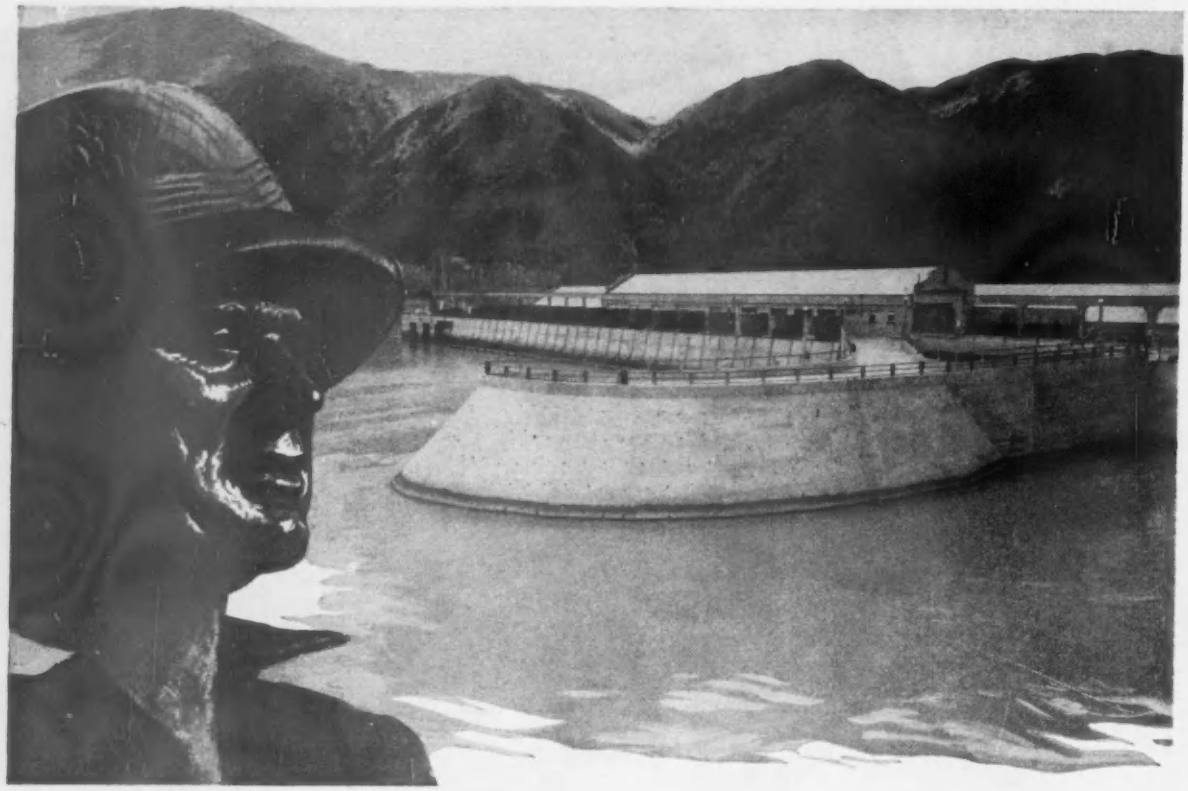
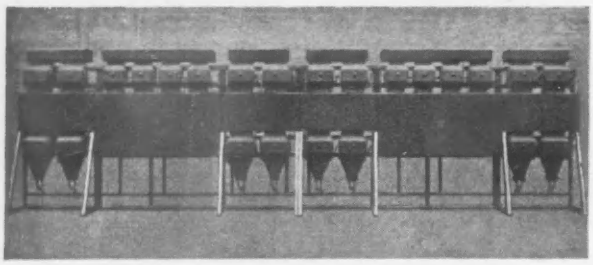
The largest manufacturers of fine enamelled wire in the world.



WHEREVER THERE'S POWER THERE'S DENNIS SWITCHGEAR



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An example of medium voltage distribution switchboard for Atomic Power Station.

Dennis heavy duty medium voltage Switchboards are operating with the greatest efficiency all over the world, in tropical, temperate and cold climatic conditions, for the centralised control of all types of lighting, heating and power circuits. Combinations of fully tested H.R.C. Fused Switches to 800 amps. and Circuit Breakers to 2,000 amps. are designed to individual requirements and will always provide trouble-free operation, ease of maintenance, saving of space and symmetry of appearance. Dennis Switchgear gives complete satisfaction by offering an extensive range of H.R.C. and Rewireable Fuseswitches, Distribution Boards, Fuses, etc., to the highest standards of electrical engineering practice, ensuring quality with economy.

DENNIS

SWITCHGEAR

Ask for Catalogue MC4

HEAVY DUTY FUSE SWITCHES

800 amps. TP and N Fuse Switch from our heavy duty 'CH' range (60 amp-800 amp), tested to 50 MVA. Catalogue No. CH380N.

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CVS-31

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NICHROME* V
for heating elements
up to 1150°C.
BIMETAL
for thermostats.
DRIVEX* CABLES
for leads.

Adults eating spaghetti always look slightly comic. Children eating spaghetti have a knack of making it look, well, child's play. That's the thing about the youngsters. They don't complicate matters.
Nor are they particularly interested in how their food came to be cooked. But we are. We are specialists in the manufacture of electrical resistance alloys, and where we come into the picture is in the heating elements for cooking apparatus, including cookers, toasters, kettles and percolators. We also manufacture bimetal for thermostats, and Drivex* cables.
By specialists we mean that we have spent more than fifty years in making and developing precisely the right alloys for these purposes. We have the confidence of leading appliance manufacturers.

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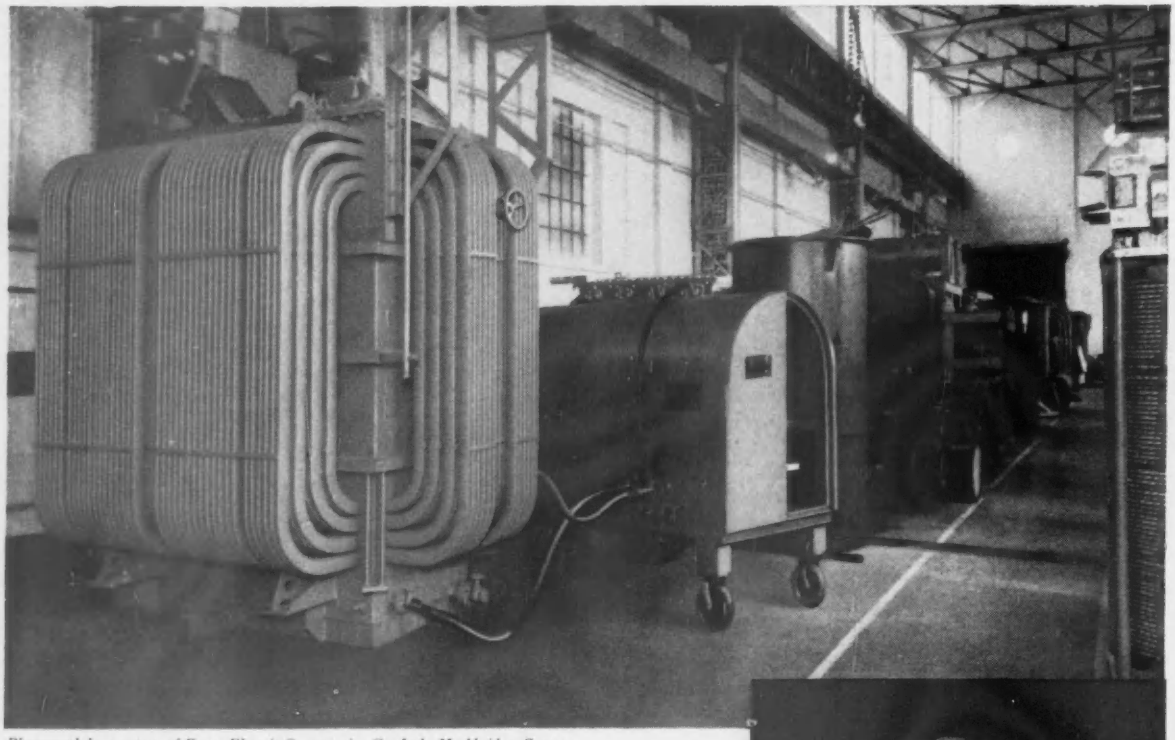
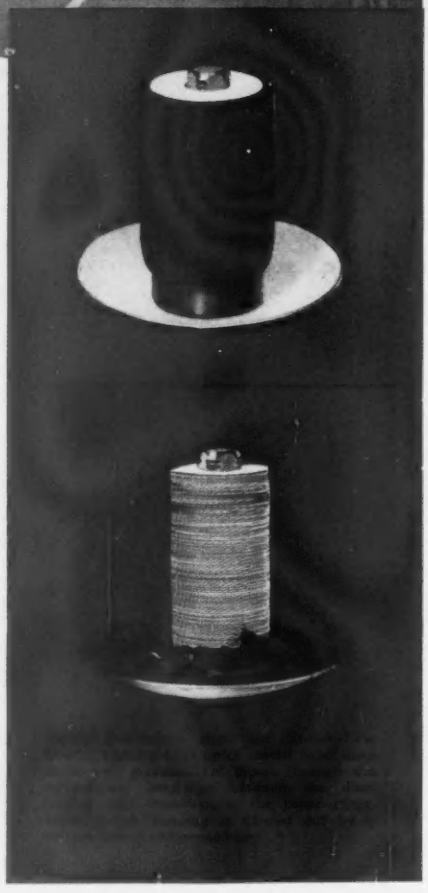


Photograph by courtesy of Bryce Electric Construction Co. Ltd., Hackbridge, Surrey.



A GOOD START IN LIFE

for insulating oil

STREAM-LINE FILTERS ENSURE SECURITY IN THE OPERATION OF CIRCUIT BREAKERS & TRANSFORMERS

New transformers and circuit-breakers need careful cleaning and drying, and must be filled with clean, dry oil. That is why so many manufacturers have installed Stream-Line filters in their works for filling transformers before they are tested and despatched.

It is also advantageous to filter insulating oil when transformers and circuit-breakers arrive on site, for at this stage no amount of care can be excessive. Subsequent periodic maintenance of the oil is also essential to security of insulation. Outstandingly important when considering security and maintenance is the fact that passage through a Stream-Line filter ensures the elimination of *all* solid impurities including the finest colloidal carbon and, in addition, the removal of all free and dissolved gases. The dielectric strength of the filtered oil is far greater than that specified for the highest quality new oil.

There is a Stream-Line filter installation or mobile unit to suit every requirement—please write for further details.

HIGH VACUUM

The standard Stream-Line filters working at moderate vacuum are fully adequate for most requirements but in order to cater for exceptional cases models are also available to operate under high vacuum. Treatment under conditions approaching absolute vacuum, combined with the unique Stream-Line edge-filtration principle, gives results with regard to the elimination of the last traces of air and moisture which are quite remarkable. Send us particulars of *your* special requirements.

STREAM-LINE

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Telephone: Normandy (Surrey) 3311-3. Telegrams: Edgefilt, Guildford.

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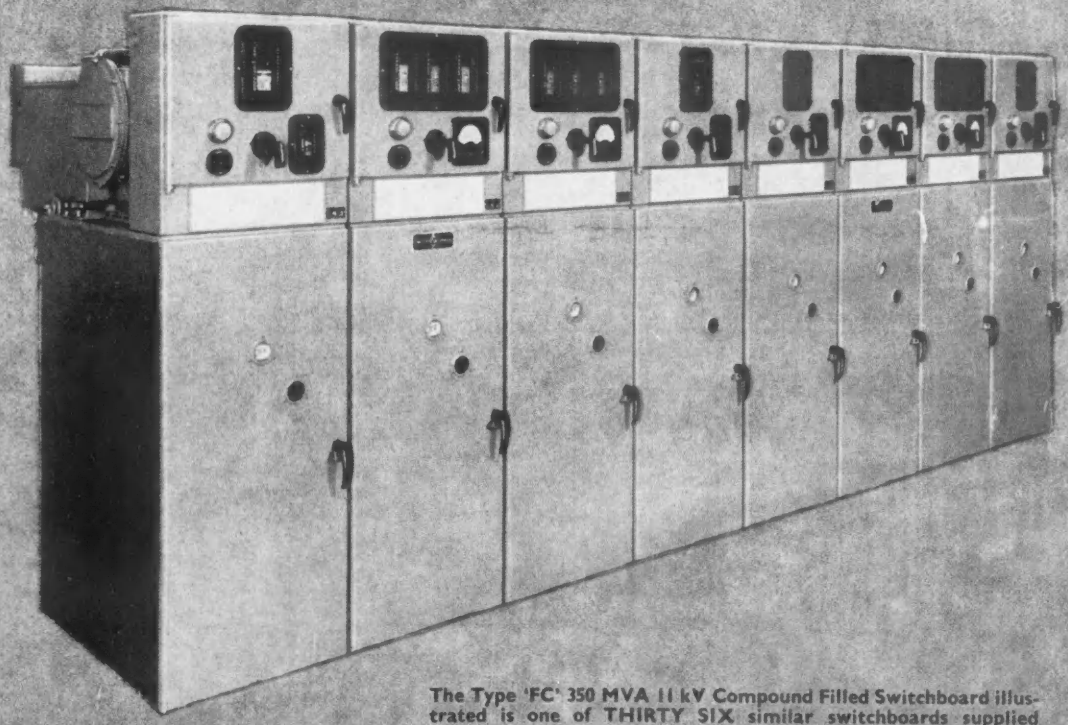
SF13

H.V. SWITCHGEAR

OF QUALITY

- ASTA Certificated to BS 116-1952 for Ratings up to 1600 amps 350 MVA at 11 kV
- Impulse Tested
- Complies with B.E.B.S. S2
- Air Insulated or Compound Filled



The Type 'FC' 350 MVA 11 kV Compound Filled Switchboard illustrated is one of THIRTY SIX similar switchboards supplied to the Government of KUWAIT Electricity Department.

J. G. STATTER & CO. LTD.

A Member of the Metal Industries Group

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INDUSTRIAL LUBRICANTS

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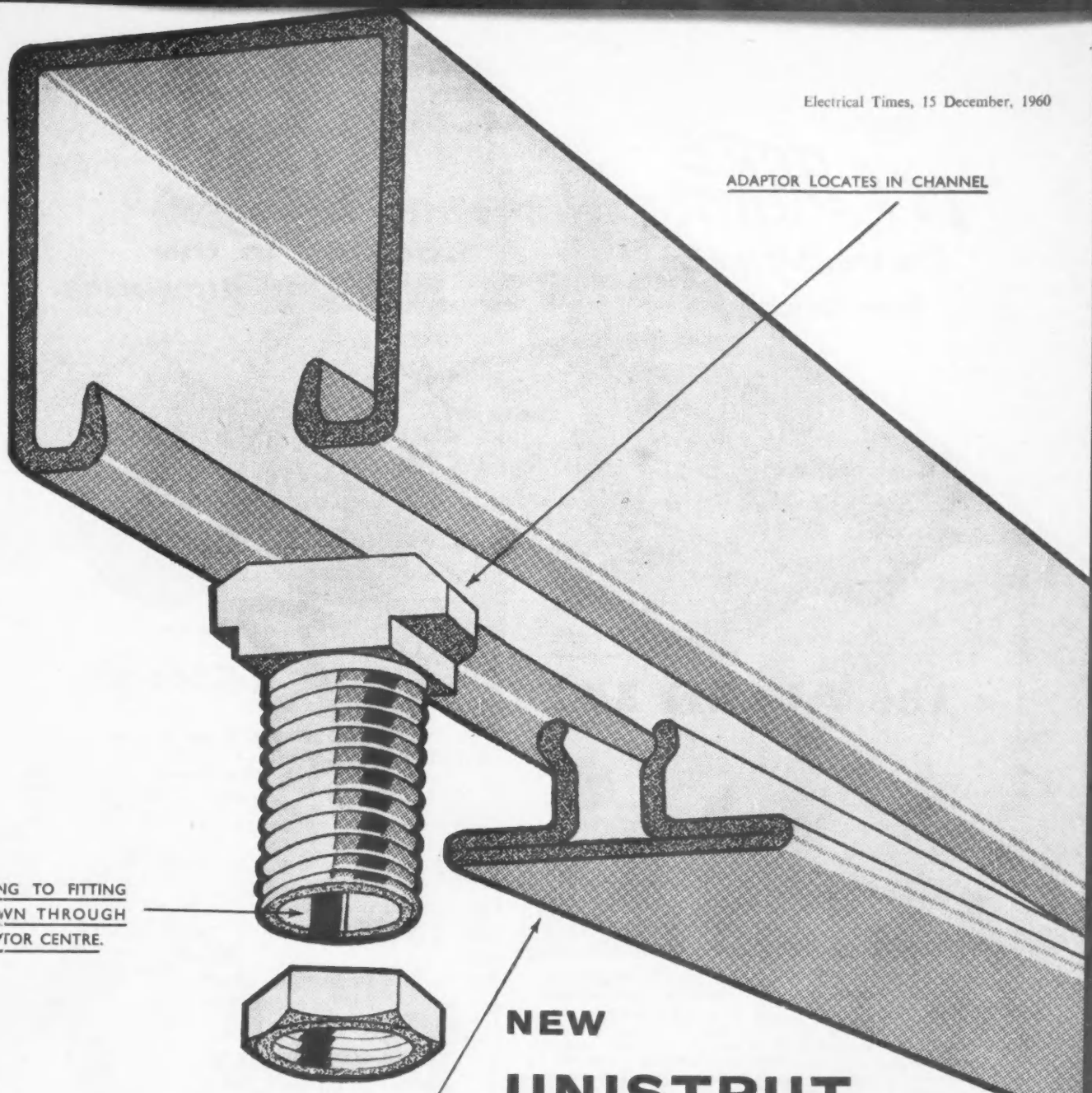
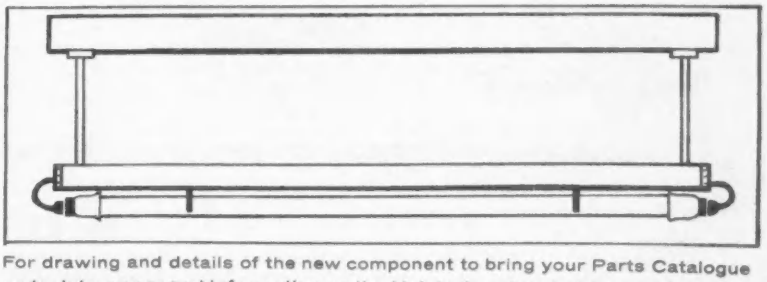

ADAPTOR LOCATES IN CHANNEL
WIRING TO FITTING DRAWN THROUGH ADAPTOR CENTRE.
WIRING IN CHANNEL CONCEALED BY PUSH-IN COVER STRIP.

NEW
UNISTRUT
FLUORESCENT
LIGHTING ADAPTOR

NEATER—MORE ECONOMICAL.



With this new component, attachment of fluorescent fittings to Unistrut channel (still the cheapest and neatest trunking) is made even simpler. The fittings may be attached either direct as shown above, or on droppers of ¾" conduit attached by a standard socket to the male thread of the adaptor. In either case, wiring is drawn from the channel through the centre hole of the adaptor which is of brass for good earthing. The end of the adaptor which fits inside the channel is shaped like the normal Unistrut nut, to combine positive location with easy adjustment of position.

UNI/610

For drawing and details of the new component to bring your Parts Catalogue up to date, or general information on the Unistrut system in fluorescent trunking and all electrical applications, please write to:

UNISTRUT DIVISION OF SANKEY-SHELDON LTD.

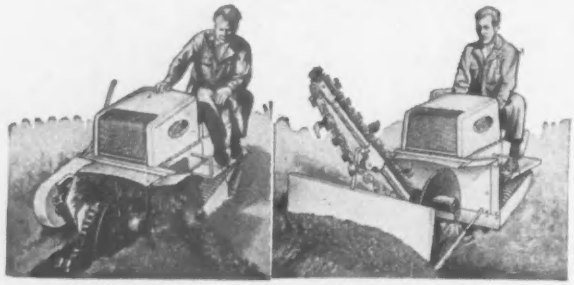
43/45 Broadwater Road, Welwyn Garden City, Herts. Telephone: Welwyn Garden City 6321 (4 lines)

vf

IT'S HERE

The trencher you've been waiting for

The ALLEN 3/12



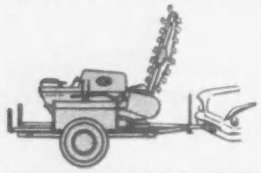
DIGGING **BACKFILLING**

This versatile small trencher and backfiller will dig trenches 3" to 4" wide, down to 5' 6" deep, or 12" wide to 2' 6" deep, with a range of intermediate width and depth capacities. The digging boom is controlled hydraulically, and can be telescoped to suit the depth of trench. It is powered by a 12½ h.p. 4-stroke engine.

The **ALLEN 3/12** is ideal for builders, plumbers, public works contractors, telephone, water, gas and electrical undertakings, etc., and offers speedy, low-cost, mechanical trenching and backfilling for an almost endless variety of jobs.

The **ALLEN 3/12** is approximately 6' 4" long, 3' 1"wide, 3' 1" high and weighs 1,350 lbs.

For transportation from site to site, a specially designed trailer is available, with tilting platform for easy loading.



Fill in and post the coupon below for full details of this superb machine.

ALLEN

To: JOHN ALLEN & SONS (Oxford) LTD COWLEY, OXFORD, ENGLAND

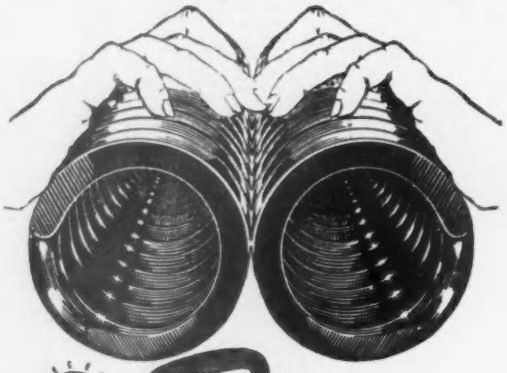
Please send full details of the ALLEN 3/12 Trencher

Name .....

Address .....

9 ..... Tel. .....

Looking in the right direction



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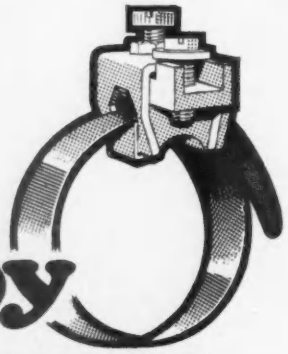
F. S. RATCLIFFE (ROCHDALE) **LTD.,**
Crawford Spring Works, Norman Road, Rochdale
Phone: Rochdale 49415 **'Grams: Recoil, Rochdale**
Telex 63178 **CWS968/1**

it pays to use the

Tenby



EC 15 ADJUSTABLE EARTHING CLAMP

Only by using an earthing clamp which fully complies with B.S.I. specification No. 951 can permanently effective earthing be assured.

The Tenby EC 15 fully complies with the vital minimum torque test figure of 80 lb. inches for a 1¼" outside diameter pipe, and also with other test requirements.

The EC 15 is provided with an earthing wire terminal, and is the most effective, simple to install, and therefore the most economical earthing clamp complying with B.S.I. 951.

S. O. BOWKER LTD.

19-21 WARSTONE LANE · BIRMINGHAM 18
Telephone CENtral 3701

Medium-size a.c. motors

FROM STOCK

IMMEDIATE DELIVERY

is offered of all the following foot-mounted induction motors. The ratings listed are for 400/440 volt, 3-phase, 50-cycle supplies.

SQUIRREL CAGE (BS 2613)

Screen-protected		Totally enclosed fan-cooled	
h.p.	*speed r.p.m.*	*h.p.*	*speed r.p.m.*
30	970	25	730
30	725	40	975
50	725	40	730
*55	720	50	1475
70	720	50	730
*75	970	65	1475
100	1455	†65	1475
100	725	†65	975
*125	1465	†80	1465
*130	970	†85	950
		100	1480
		†100	1450

SLIPRING (BS 2613)

Screen-protected	
h.p.	*speed r.p.m.*
30	965
50	1450

**drip-proof enclosure*

† *totally-enclosed closed air circuit motors, radiator cooled.*

For further details of these and other AEI stock motor ranges, please contact your local AEI district office or Industrial Machines Dept., Mosley Road Works, Trafford Park, Manchester 17. Telephone No. Trafford Park 2431. Extension 1212.

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Associated Electrical Industries Limited

Motor & Control Gear Division

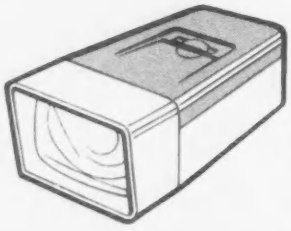
RUGBY AND MANCHESTER, ENGLAND

PLEASE HELP SPASTICS

A1573

TAKE A GOOD VIEW!

18 mouldings-just one fixing screw



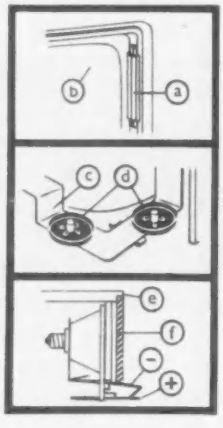
Keen on photography? Next time you pass a photographic shop look at this brilliant, new, colour-viewer by Johnsons of Hendon Ltd. As a photographer you will appreciate its undoubted efficiency and the advantages of its variable magnification. The ingenious arrangement for holding the slide in position also closes the electrical circuit to provide illumination without resort to finger-pressure or a switch.

As a plastics engineer or user, you will be impressed by the superlative finish of the two-colour injection mouldings, the single fixing screw and the unique way the lenses have been secured. We co-operated in the design, made the tools, produced the mouldings and handled assembly and packaging. Our associate company the British Optical Lens Co. designed and produced the glass lens system.

The wedge (a) holds the lens (b) in position securely, yet allows for minor alignment adjustments.

Electrical contact strips (c) are attached by metal fasteners (d) which clip over plastic pins.

The overlapping ledge (e) holds the slide (f) in position and simultaneously completes the electric circuit.



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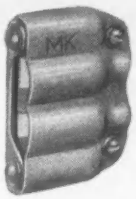
BOXES AND CLAMPS FOR M.I.C.C. CABLE

CABLE CLAMPS

Cable clamps are suitable for single or twin-core mineral insulated copper covered cable 0.0015 to 0.003 cross-sectional area.



List No. 901—single entry cable clamp.

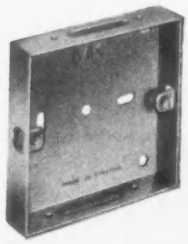
List No. 902—double entry cable clamp.

MK have introduced a new range of boxes and clamps for MICC cable. Single or double entry clamps are interchangeable with any of the boxes and are supplied separately with fixing screws and shakeproof washers. Steel boxes and cable clamps are zinc plated.

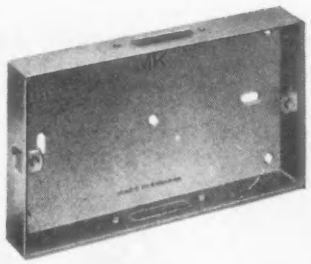
WRITE FOR LEAFLET 257

PLASTER-DEPTH BOXES FOR M.I.C.C. CABLE

These boxes have one clear entry and one knockout for attaching either single or double entry cable clamps.



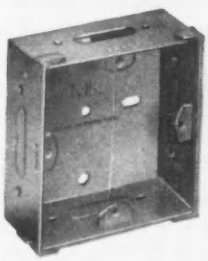
List No. 3951—Plaster-depth box with $2\frac{3}{8}$" fixing centres.



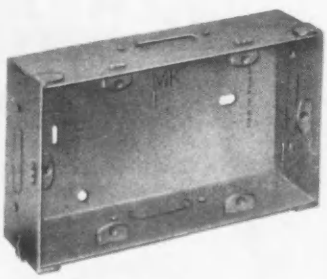
List No. 3952—Plaster-depth box with $4\frac{3}{4}$" fixing centres.

DEEP BOXES FOR M.I.C.C. CABLE

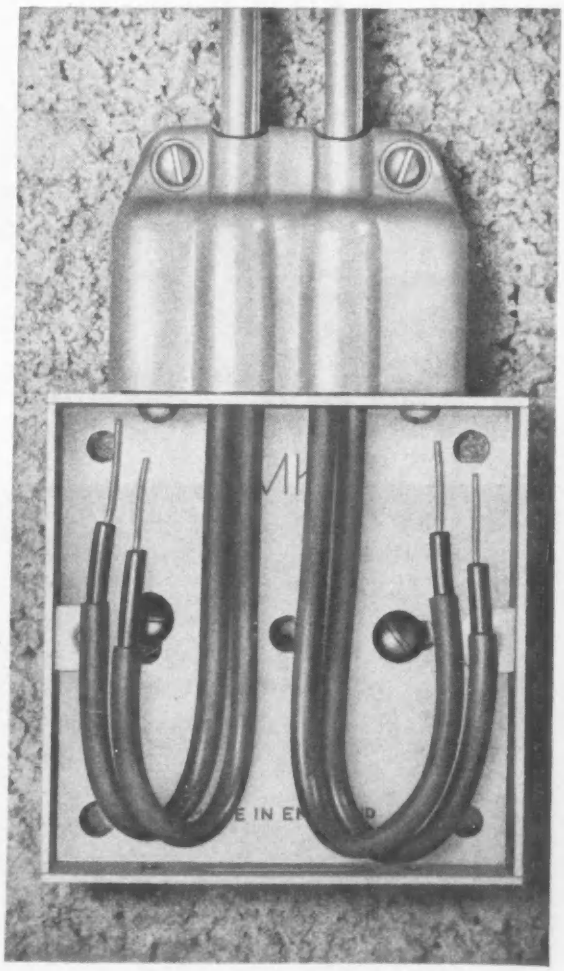
Deep boxes have one clear entry on one side and one knockout on each of the other three sides and one in the back to which can be attached a single or double entry cable clamp.



List No. 881—Box to BS 1299/1363 dimensions having $2\frac{3}{8}$" fixing centres.



List No. 882—Box to accommodate any two gang MK accessory.



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accurate particle size analysis

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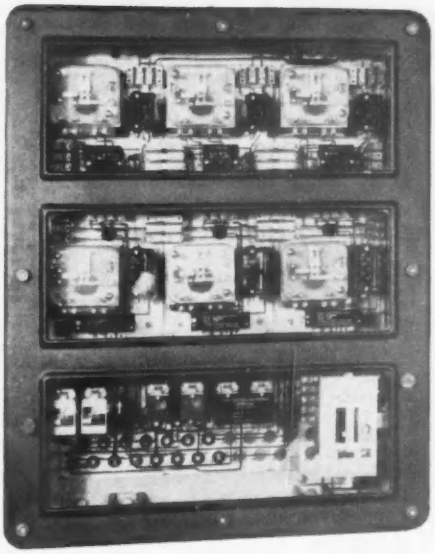
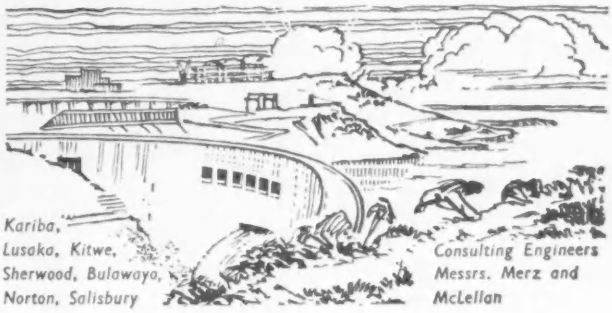


KARIBA

330-kV Transmission System Protected by Reyrolle Type-H Distance Protection



Kariba, Lusaka, Kitwe, Sherwood, Bulawayo, Norton, Salisbury

Consulting Engineers Messrs. Merz and McLellan

Reyrolle type-H high-performance distance protection incorporates the following important features:

- High speed for all types of fault
- Accurate measurement for exceptionally wide range of source to line impedance
- Negligible over-reach on D.C. transients
- Separate moving-coil elements for earth-faults and phase-faults
- All relay-elements identical and easily removable
- Self-contained design reduces panel wiring
- Built-in phase-selectors for single-phase auto-reclosing if required

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EXTENSION TO RANGE

Brush type HF 11 High-Voltage Switch-Fuse Units for indoor or outdoor service are an economical method of controlling and protecting power transformers. Extensive technical development of powder-filled fuse-links for use in the air-insulated fuse chamber of Brush units has resulted in the availability of much higher current rating fuse-links enabling these switch-fuse units to be used for the control of 1500 kVA 11 kV transformers.

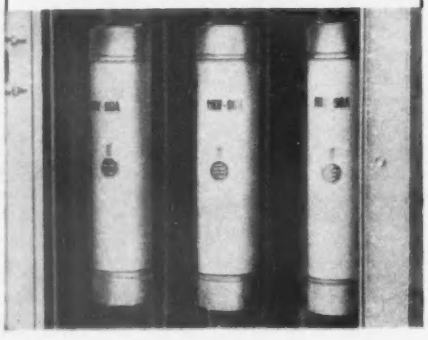
BRUSH

BRUSH ELECTRICAL ENGINEERING CO LTD

LOUGHBOROUGH ENGLAND

A Member of the Hawker Siddeley Group

Type HF 11 Switch-Fuse unit, with chamber door open, showing 90 ampere 11 kV fuse-links.



S7

NEWS SHEET

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GEC join with Electrolux in refrigerator work to give quicker results on domestic units using thermo-electric principle. Small portable box coolers evolved, other development work proceeding. Both companies to market own models. (939)

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Bonus scheme gives higher payment to maintenance staff for fewer breakdowns. Application in paper making works also provides for installation and modification work. (908, 921)

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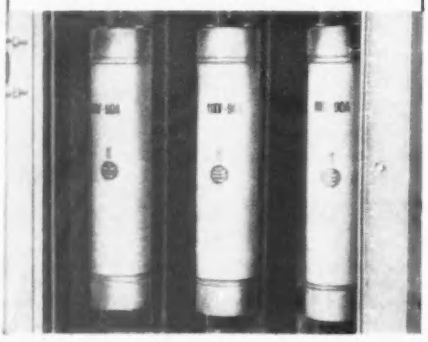

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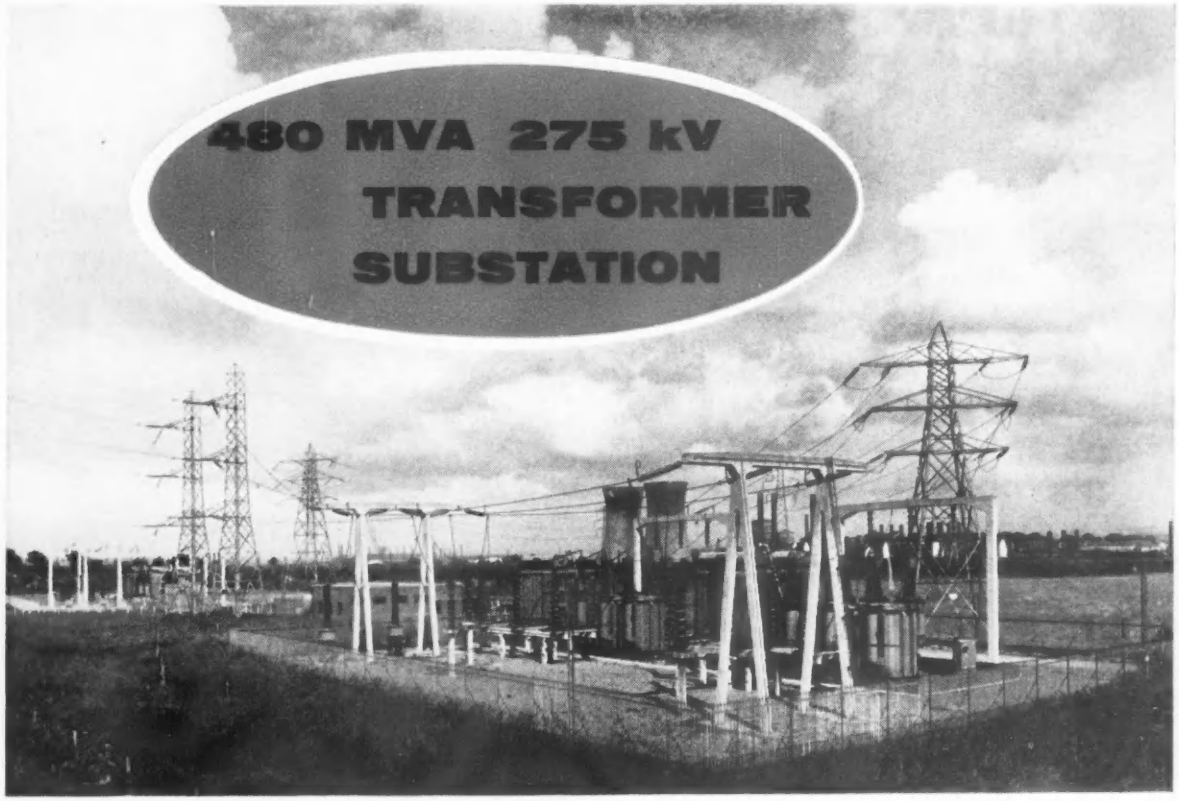

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Two 225 MVA 16/285 kV generator transformers, the largest double-wound transformers so far ordered for Scotland, for the Kincardine-on-Forth power station of the South of Scotland Electricity Board.

Four 30 MVA 220/66 kV transformers and seven 15 MVA single-phase units to form two 45 MVA 220/22 kV three-phase banks (one spare unit) for the State Electricity Commission of Victoria.

Two 90 MVA 275/33 kV transformers for the Ravenscraig substation of the South of Scotland Electricity Board.

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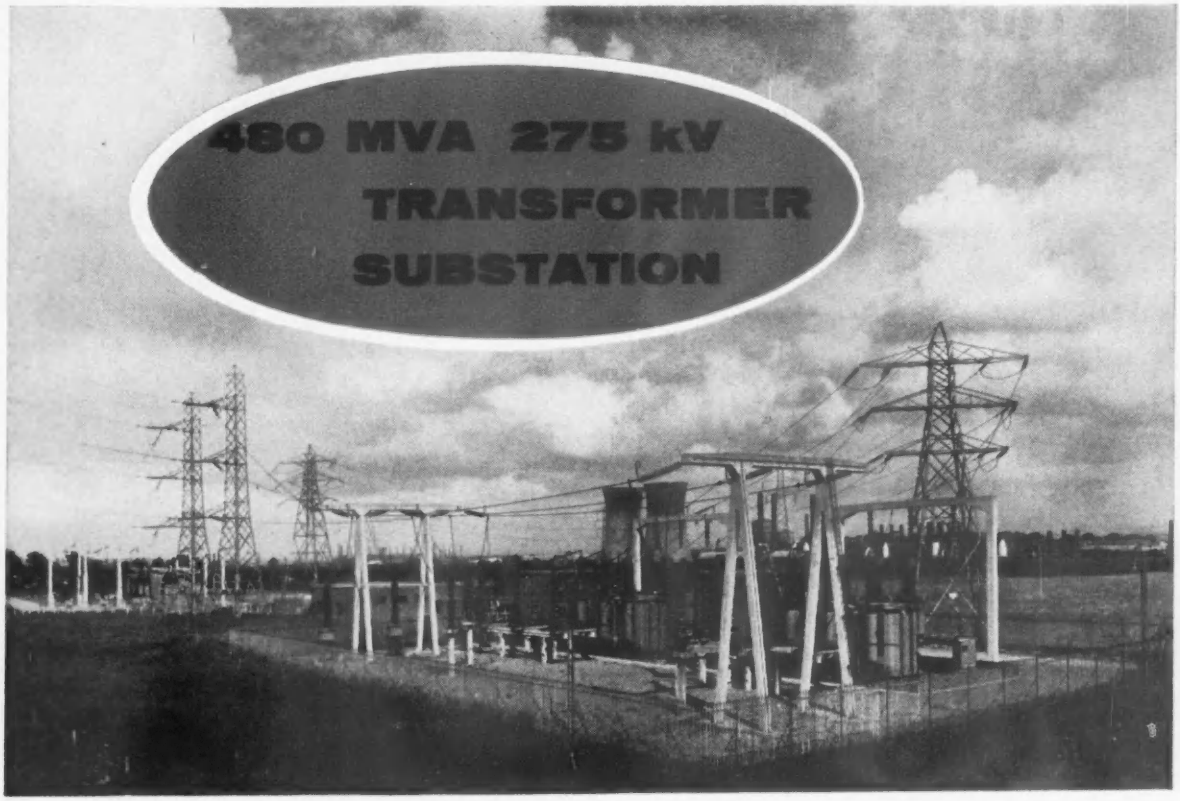

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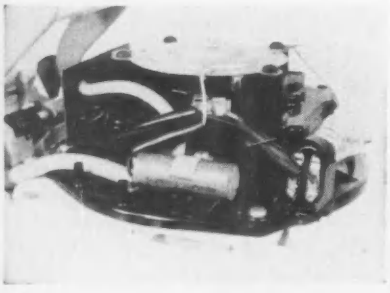

**Ring Tongue Terminals in use on Hoover cleaner.*

Hoover de-luxe Cleaner (Model 652) seen with its comprehensive range of cleaning tools and Hooverflex hose.

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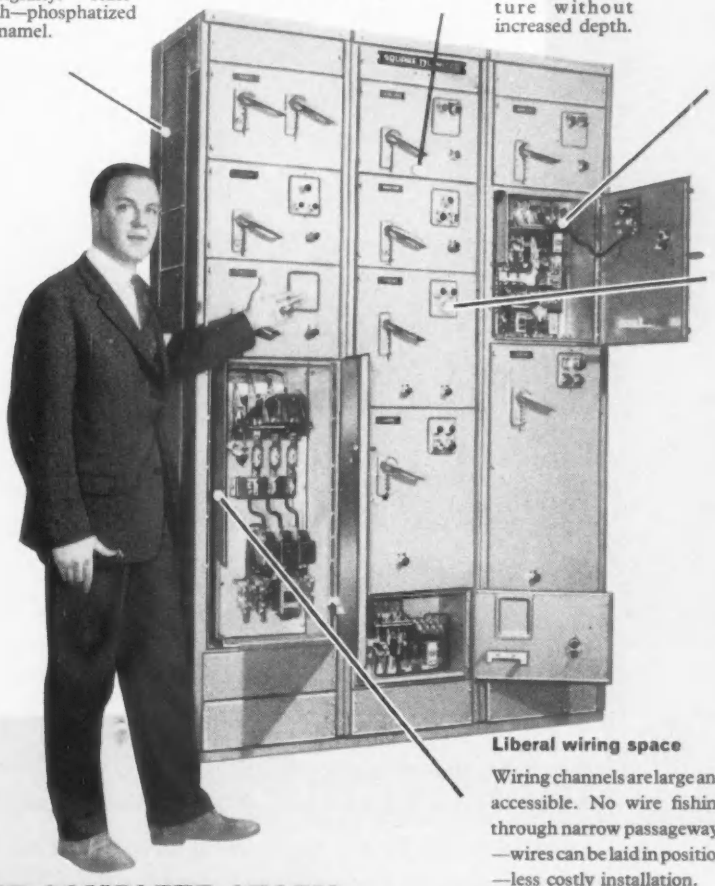
AP 147

NOTE: ONLY SQUARE D CONTROL CENTRES HAVE THESE PLUS FEATURES

Industrial Construction
All outer surfaces and structural parts are 12 gauge steel. Corner channels, cross members and doors are formed on special dies for maximum rigidity. Rust-resisting finish—phosphatized plus stoved enamel.

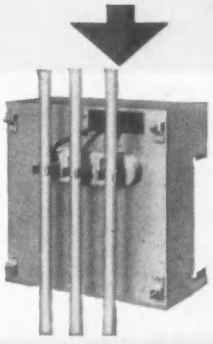
Saves Space
Unit heights in 3-inch increments—an exclusive Square D advantage which permits use of units with minimum heights, eliminates the wasted space typical of modular systems. Back to back mounting of units is available within standard structure without increased depth.



Built-in safety
Units are metal enclosed to confine damage should a fault occur. Unit side plates are permanently attached—can't be accidentally discarded. Switch-type units have visible blade disconnects for added safety.

Extra control flexibility
A variety of removable door-mounted panels accommodates up to four oil-tight push buttons and pilot lights.

Tubular vertical buses feed plug-in units
Another Square D "exclusive"—inherently stronger—greater cooling surface. Extra-wide spacing between phases gives added "breakdown" protection. Plug-in stabs are silver-plated copper backed by steel springs—give high pressure, low resistance contact at all times. Bus bars are also silver plated.



Liberal wiring space
Wiring channels are large and accessible. No wire fishing through narrow passageways—wires can be laid in position—less costly installation.

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BULLETIN 8998 gives detailed information on all of the "plus" advantages you get when you specify Square D motor control centres. Send for a copy.

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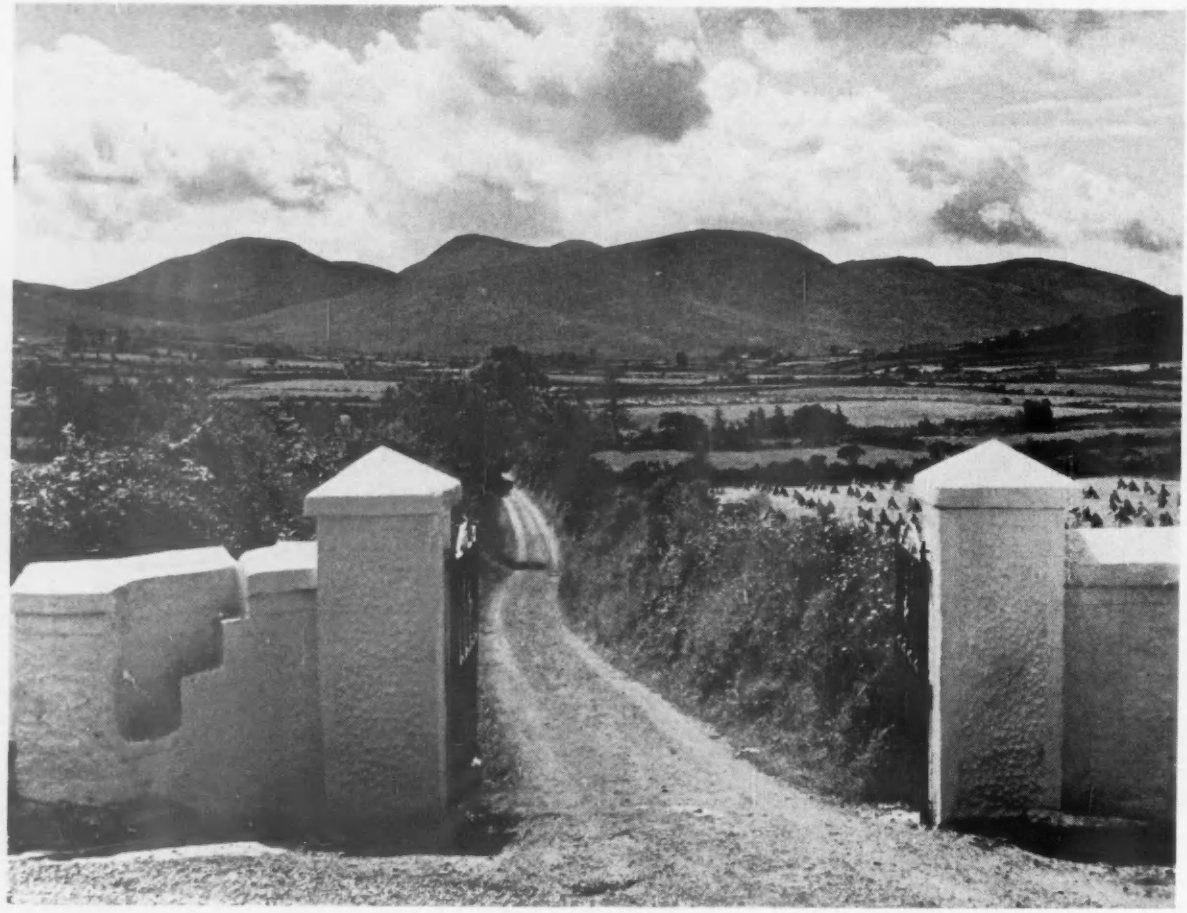
'Tis distance lends enchantment to the view,
And robes the mountain in its azure hue.

(Pleasures of Hope by Thomas Campbell)



By courtesy of Tourist Information Centre, Belfast

Irish cables are manufactured amidst scenery depicted above, showing the famous and beautiful Mourne Mountains.

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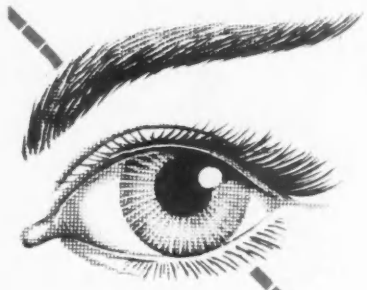

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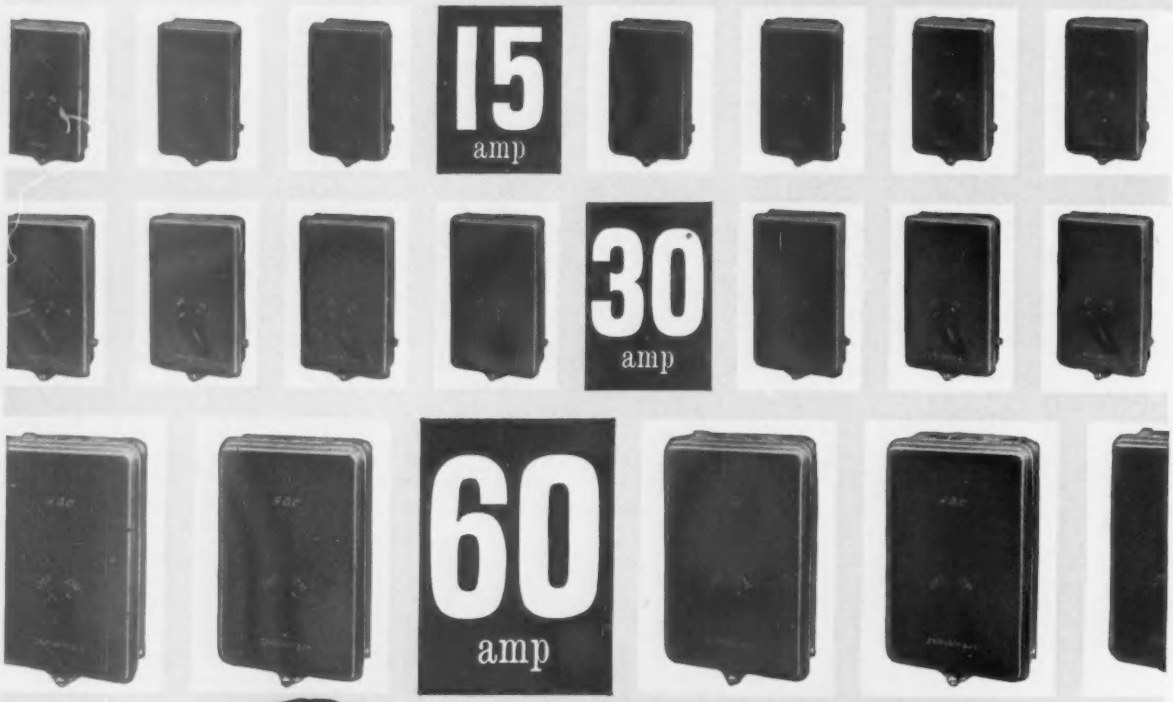

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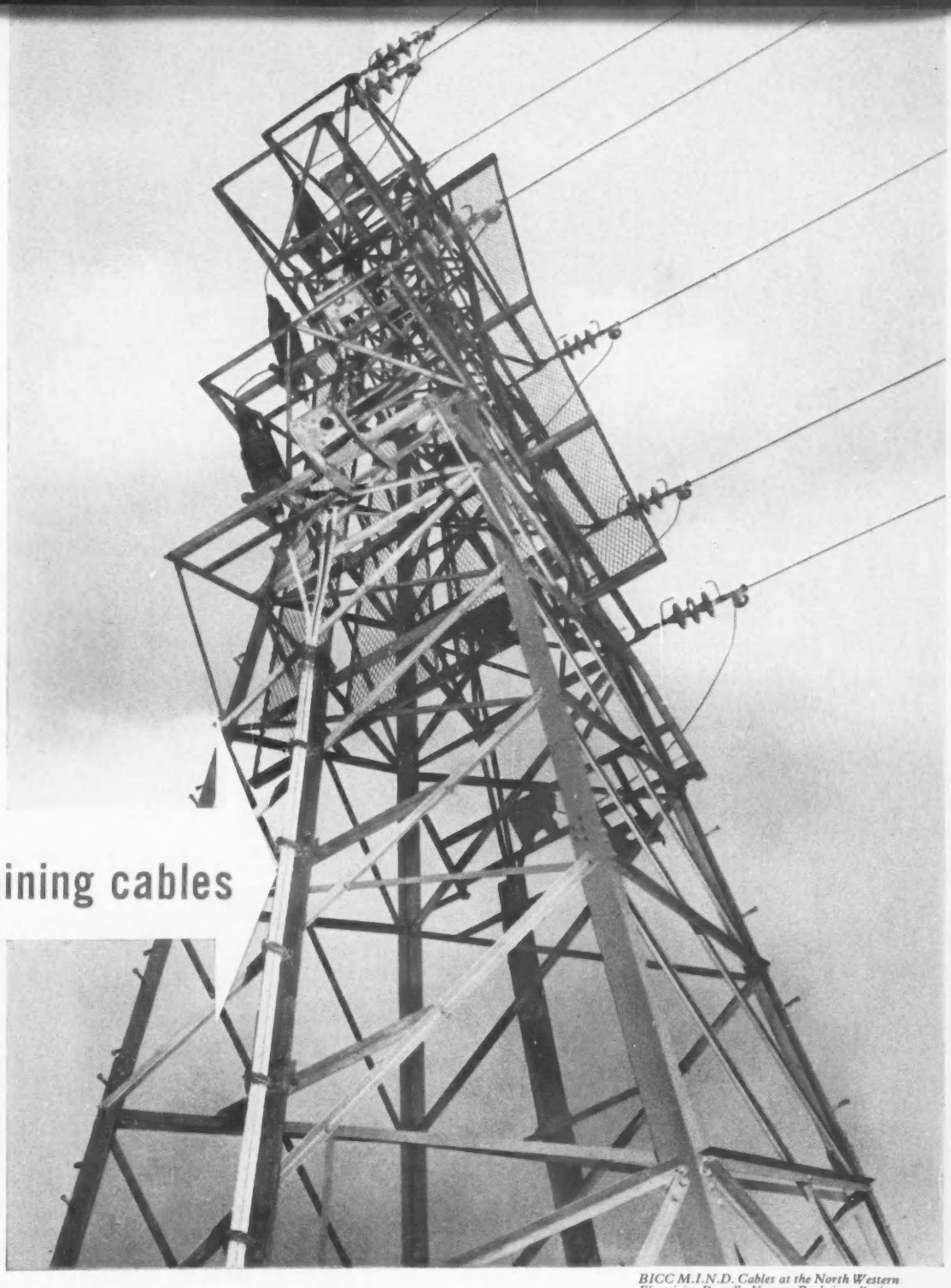

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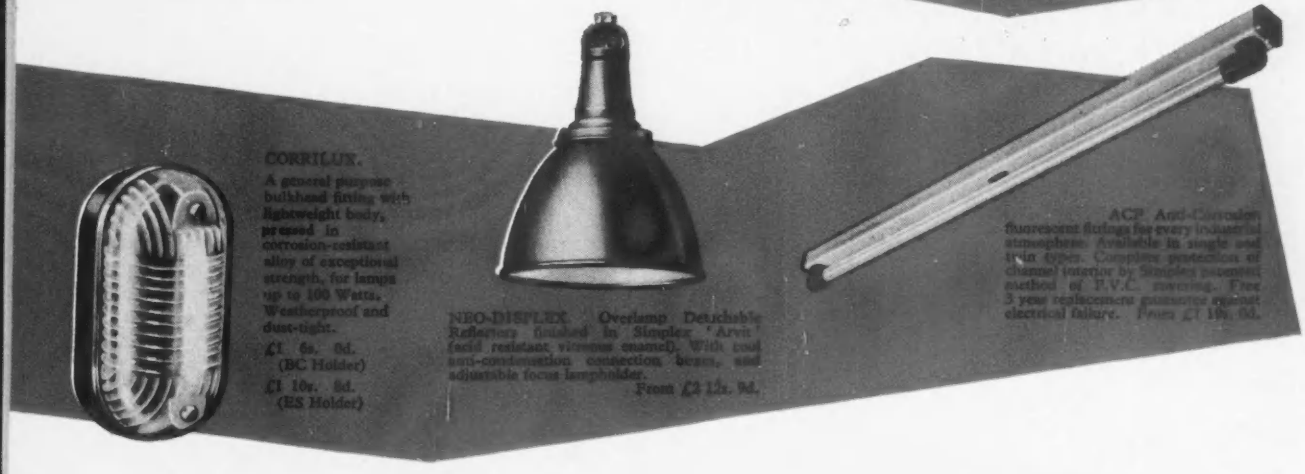

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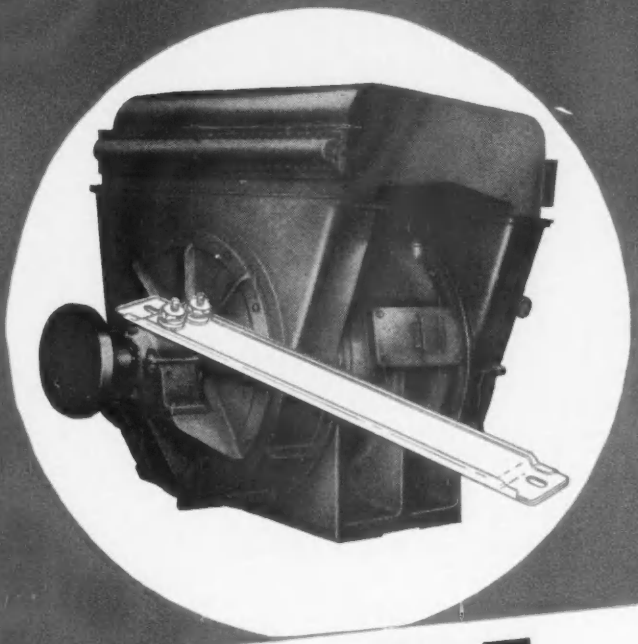

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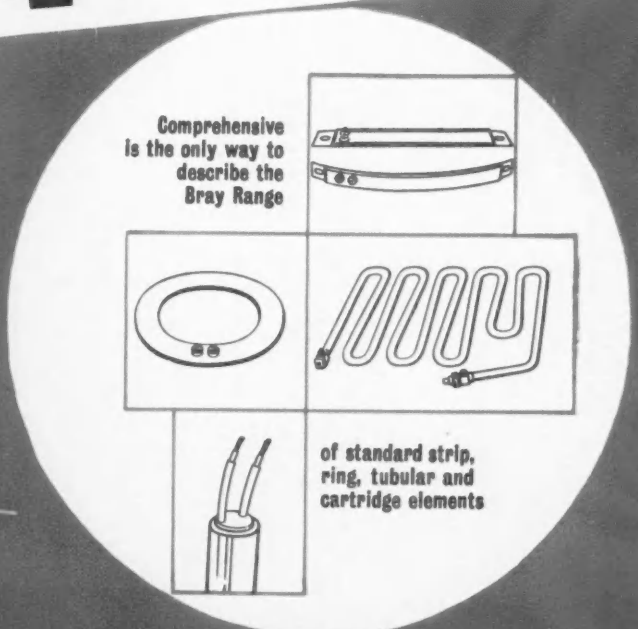

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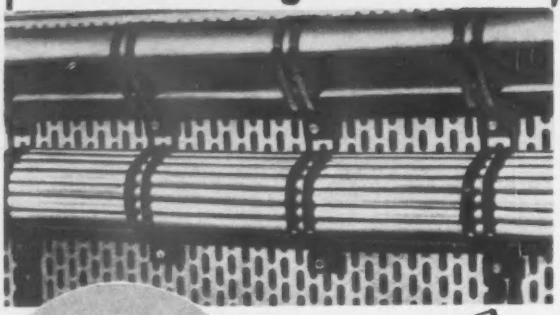

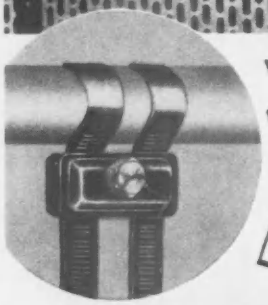

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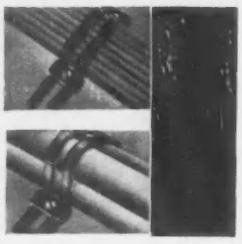

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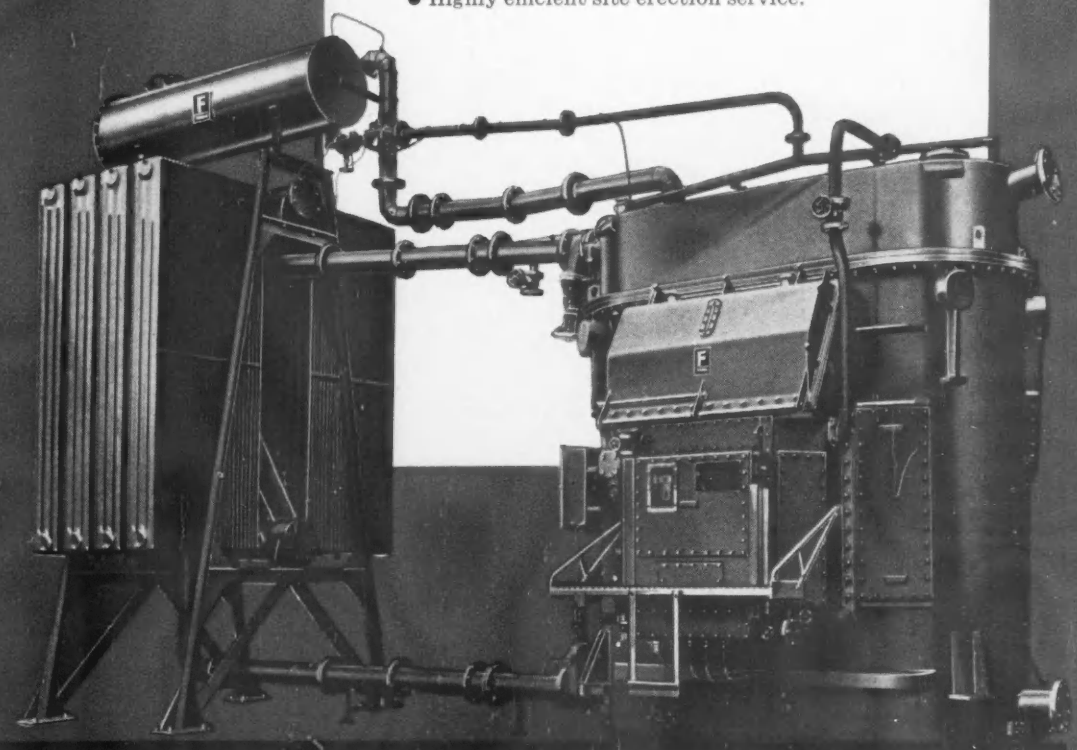

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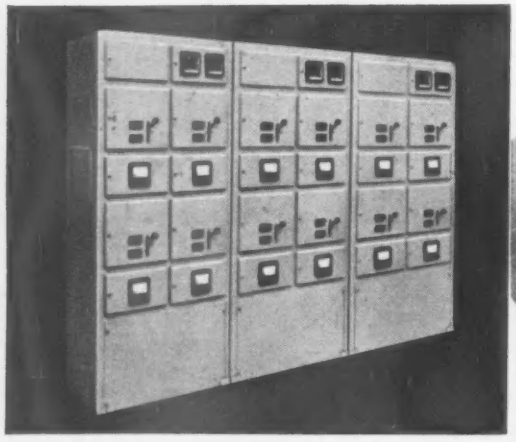

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THURSDAY 15 DECEMBER, 1960
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ELECTRICAL TIMES

SARDINIA HOUSE, SARDINIA STREET, LONDON, W.C.2
Telegrams: Equivolt . Estrand Telephone: HOLborn 6016

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Marine Self-regulating Alternators—Part 2 912
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Dans ce numéro

Le Réacteur Rapide de Dounreay 909

Le réacteur nucléaire à reproduction rapide de Dounreay causa quelque souci en novembre de l'an dernier. Par la suite, il fallut le fermer dans le but d'y effectuer certaines modifications comprenant le remplacement du noyau d'assemblage. Il fallut également faire certains changements en vue de prévenir le coincement de la bielle de contrôle et l'introduction de gaz oxydants dans l'alliage de sodium-potassium employé pour l'enlèvement de la chaleur du noyau. Il est envisagé d'augmenter l'énergie l'an prochain et il devrait être possible d'atteindre, en décembre, une opération de 15/20 MW.

Alternateurs Autorégulateurs—2ième Partie ... 912

Trois conceptions d'alternateurs autorégulateurs pour l'usage de la marine ont des compensations et pour le changement de courant et pour l'élément de changement d'énergie de la charge. Dans chacun des cas, un alternateur de construction conventionnelle est utilisé

Nouvelle Usine pour Turbines 916

L'un des grands groupes techniques ont centralisé dans une seule usine la fabrication de turbines à vapeur et de turbines à expansion à gaz. Des laboratoires d'inspection et de développement très complets ont été inclus. Les installations d'essais consistent de chaudières à vapeur pour le chargement à vapeur de turbines ayant un rendement maximum de 5 MW et pour quatre gazéificateurs à piston libre pour la vérification d'essais sur l'expansion des gaz dans les turbines, à un maximum de 10,000 c.v.

Caractéristiques des Fours à Arc Electriques 923

Afin de pouvoir déterminer les caractéristiques électriques des fours à arc pour la fusion de l'acier, un essai de court circuit simple peut être employé. Comme résultat, un diagramme peut-être tracé dans le but d'obtenir des résultats qui soient suffisamment précis pour en arriver à des fins pratiques.

In dieser Nummer

Schnellreaktor DOUNREAY 909

Der schnelle, regenerative Reaktor (Britreaktor) des Kernkraftwerks DOUNREAY (schottland) erreichte im November 1959 den kritischen Betriebszustand. Er wurde später ausser Betrieb genommen zur Durchführung gewisser Umbauarbeiten, bei denen der Kernaufbau erneuert wurde und Konstruktionsänderungen vorgenommen wurden mit dem Ziel, das Hängenbleiben der Regelstäbe sowie das Mitreissen oxydierender Gase durch die zur Wärmeableitung aus dem Kern verwendete Natrium-Kaliumlegierung zu verhindern. Nächstes Jahr soll die Leistung dieses Kraftwerks derart erhöht werden, dass sie bis Jahresende 15—20 M.W. beträgt.

Selbstregelnde Wechselstromgeneratoren, II ... 912

Besprochen werden drei verschiedene, für den Einbau in Schiffe geeignete Konstruktionen, die sowohl Stromschwankungen wie Anderungen des Leistungsbedarfs automatisch ausgleichen. In allen drei Fällen ist der verwendete Wechselstromgenerator von herkömmlicher Bauart.

Turbinenbau 916

Eine Gruppe namhafter Maschinenbaufirmen hat die Herstellung von Dampfturbinen, Gasturbinen und Expansionsgasturbinen in einem Werk zusammengefasst. Das neue Werk verfügt über ausgedehnte Prüfanlagen und Versuchslaboratorien, darunter eine Dampfkesselanlage für die Probebeaufschlagung von Dampfturbinen mit einer bis zu 5 MW entsprechenden Leistung sowie vier auf Freikolben arbeitende Vergasungsgeräte, mit denen Expansionsgasturbinen für Leistungen bis zu 10 000 PS geprüft werden können.

Kennziffer elektrischer Lichbogenöfen 923

Mit Hilfe einer einzigen Kurzschlussprobe lassen sich die elektrischen Kennziffer eines zur Stahlschmelze ausgelegten Lichtbogenofens ermitteln. Die Genauigkeit eines hierauf beruhendn Diagrams reicht für die meisten praktischen Zwecke aus.

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ELECTRICAL TIMES

ESTABLISHED 1891

THURSDAY, 15 DECEMBER, 1960

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K. C. POUNDS, B.Sc.(Eng.), A.C.G.I., A.M.I.E.E.

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T. W. WRIGHT

Comment

STANDARDS FOR APPROVAL

Publication last week of two important British Standards for domestic electrical appliances brings a reminder that standards in this category must now be looked at in the light of the imminent operation of the British Electrical Approvals Board for Domestic Appliances (BEAB). It is this body which will operate the long-heralded electrical industry's approvals mark scheme, and one of its first decisions has been to contract-out from any intention of producing test specifications itself. It will award its mark to equipment that satisfies an appropriate British Standard —or, more precisely, the safety clauses of a British Standard. This is a distinction that may prove troublesome when the scheme gets going, although those responsible are confident that no major difficulty will result. It is noticeable that of the two standards appearing last week, that on electric domestic irons, a revision, includes safety precautions and operating requirements; while the standard on domestic electric clothes-washing machines "does not deal with performance requirements but is concerned primarily with safety precautions." Until some new specification is produced—and there is rumour that a British Standard may be prepared concerned solely with safety requirements for domestic electrical appliances—the fact that the BEAB mark will presumably indicate something less than full compliance with the BS on irons, must cause confusion; especially as that standard, like others in its field, includes a reference to the BSI kite mark as an indication that all requirements are satisfied. Nor is the washing machines standard free of clauses that might not attract BEAB checking. No doubt ways around these difficulties will be found. What the electrical industry will want to be assured is that the solutions will not be such that the new scheme is lowered in the estimation of the public, who in any case are unlikely to take kindly to the realisation that the mark will imply safety only, not quality in any other sense.

DOUNREAY PROGRESS

When the Dounreay fast-breeder reactor experiment was first conceived, uncertainties about fuel supplies generally, and fissile fuel in particular, made its breeder characteristic an outstanding attraction. Today, the possibility that a commercial reactor operating on this principle may produce more fissile fuel than is fed into it is of secondary importance and unlikely to be a major factor in planning. However, the other characteristic of the system, that it uses "fast" neutrons, without slowing them down by a moderator after they are born in a fission process, has grown in significance. The fast fission process offers potentially

promising conditions for using the plutonium which will be an unavoidable by-product of the gas-cooled, graphite-moderated, natural uranium reactors soon to come into operation on the supply systems. Thus, at present, UK policy sees the fast-breeder reactor as a type required for the 1970s, probably as an ancillary to plutonium-producing reactors using natural or slightly enriched uranium, which will continue to be built even after fast reactors have proved themselves practicable. Progress in that direction was considered last week at a symposium organised by the Institution of Mechanical Engineers. As always when Dounreay is considered, the ingenuity of the mechanical engineering stood out in what was a generally satisfactory progress report. But it is clear that the coolant problem, with its reliance on liquid metals for removing heat from a core that operates at extremely high power densities, is proving extremely troublesome.

PAY BY RESULTS

How to pay a bonus to maintenance staff in factories is a problem that has engaged the attention of many works engineers. The difficulties are apparent; it is not easy to set a standard output and, in any case, lots of hard work by maintenance staff may signify a lot of breakdowns, which, from the production point of view, it is far better to be without. A partial solution is to let maintenance men share in general production bonus earnings through some linking formula, but if that is done the connection between maintenance effort and the return is undesirably tenuous. An ingenious solution is described in an article in our *Industrial Electricity* feature; to tie a bonus payment to the time for which production machines are available. Put another way round, the bonus depends on the success of the maintenance staff in preventing unscheduled breakdowns. The scheme is tied as well to more easily measured work effort on new installation and modification jobs, but it is the "machine non-availability factor" feature, as those operating the scheme name it, that makes it particularly worth the attention of works engineers. The snag would seem to lie in negotiation of the starting point, a standard for this "machine non-availability factor," but this has been overcome at one works, at least.

HIGH-COST H.V. AMENITY

The decision of the CEGB to move to four-conductor bundles for its future bulk-transmission lines, noted briefly in our pages last week, represents a major investment in meeting amenity objections to overhead lines. This effect of the change was rather overshadowed in the official announcement by the somewhat nominal, if grand-sounding, change from 380 kV to 400 kV as the stated voltage for the lines. In contrast, the change in conductor arrangement is both significant and expensive. Four-conductor bundles using the standard 0·4 sq in. copper-equivalent s.c.a. conductors will necessitate heavier towers, which in turn are to be taller. The main outcome of the change will be that quite often a single line of double-circuit towers will suffice where two lines of towers would have been needed before. This means less lines and less wayleave trouble, so it is a substantial contribution to amenity. However, doubling the conductor area is not going to double the transmission capacity of the lines; increasingly, stability considerations set the limit to what a major transmission line will carry in the CEGB system, rather than the current rating of the conductors as determined by thermal considerations. From the stability aspect, it is voltage and (through its effect on reactance) conductor configuration that have most effect on permissible line loading. The four-conductor bundle design will help to a limited extent in this respect, but not proportionately to its greater area, as the official estimates show: 2,000 MW for a double-circuit with twin conductor bundles and 3,000 MW for four-conductor bundles. Thus, the change has limited technical advantage, a fact which should be brought home to those who are most vociferous about amenity. They have got to be persuaded that towers 20 ft higher and twice the subtended angle of conductors across the skyline have been decided on in their interests at considerable cost to the ordinary consumer.

A CASE FOR LIGHTING MOTORWAYS

Government policy at present is firm that there should be no general lighting on motorways; but experience abroad permits some doubt as to whether that decision will remain as traffic density increases on a growing mileage of British motorways. If there should be a move to lighting, it is clearly unsatisfactory to assume that the lighting design criteria should be the same as for normal, non-reserved, traffic routes. The paper which Mr J. M. Waldram presented this week to the Illuminating Engineering Society tackles this basic question from the aspect of the assistance the motorway user requires from artificial lighting; and he concludes with a list of desiderata which will try the abilities of both equipment manufacturer and public lighting engineer if full-length lighting is called for. Yet, although this specification is the declared limited object of the work which the paper reports, almost inevitably it builds up a powerful statement of the case for lighting—at least, if it is accepted that the motorways will be used to the extent which can justify the high cost of their construction. Absence of lighting implies acceptance of driving on headlights; and that is made to sound marginally satisfactory with present traffic densities, and a highly doubtful exercise if night traffic becomes moderately heavy. Nor does the problem stop there. Some natural hazards, notably patchy fog, are catered for far more safely if there is some general lighting. All this makes present policy appear highly suspect.

Meteor

This week's quick summary of electrical news faces advertisement page 20

Progress at Dounreay

PROGRESS with the UKAEA's experimental nuclear reactor at Dounreay was considered at a symposium arranged by the Institution of Mechanical Engineers last week. The papers presented describe constructional and commissioning experience as well as dealing with physical and metallurgical topics. The background to the Dounreay experiment is sketched in an introductory paper by Mr R. V. Moore, G.C., B.SC.(ENG.), M.I.MECH.E., and Dr R. Hurst, G.M., M.SC., PH.D.

Dounreay as a project dates from 1951, when the fast-breeding idea first began to receive serious engineering consideration in the UK. In fast reactors, the neutrons emitted when a nucleus fissions are not slowed down ("moderated") as with graphite reactors before continuing the chain reaction by causing further fissions. The physics of the process is such that natural uranium cannot be used but, on the other hand, there is less concern about absorption of neutrons in structural materials within the core and there is a good chance of using plutonium as a fuel. Further, the neutron economy is such that "breeding" is possible; more fissile nuclei may be generated through productive absorption of neutrons than are used up in sustaining the chain reaction.

The reactor is essentially a highly-rated device, with a small core, and a high power/volume ratio. Leakage of neutrons from the core is an important factor and to conserve them it is necessary to surround the core by a blanket of natural or depleted uranium in which U 238 can be transmuted into Pu 239. Power rating in a fast reactor may be about 1 MW/kg fuel as against 1 MW/250 kg for graphite-moderated natural uranium reactors.

The Dounreay project has five main purposes:

1. To explore the operating and safety characteristics of this class of reactor.
2. To examine the kinetic behaviour of the reactor when subjected to imposed changes in reactivity or coolant flow rate.
3. To provide a fast-neutron flux-irradiation facility for the development of fast-reactor fuels and structural materials.
4. To further the development of liquid-metal circuits.
5. To investigate generally problems associated with the use of plutonium-based fuel.

The general arrangement of the reactor is shown in Fig. 2. At present, metallic fuels are used, although consideration is being given to other forms such as oxide and carbide ceramics and dispersions of such ceramics or suitable inter-metallic compounds in matrices of stainless steel or molybdenum.

Heat removal from the compact core is one of the major problems in a fast reactor, and liquid metals have proved particularly attractive in this respect. Sodium has many advantages, including good resistance to irradiation damage, high boiling point, good heat transfer characteristics and relative inexpensiveness. However, sodium has a freezing point above the usual ambient temperature, so that the system must be kept hot at all times and it becomes highly gamma active after irradiation, so that heavy shielding of coolant circuits is necessary. There are corrosion problems as well, and special precautions have to be taken to prevent contact between sodium and water, which react violently together. Although there has been much advance in sodium technology, the authors observe that there is still much to be learned. At Dounreay, sodium is used in an alloy with potassium (70%-30%) to lower the freezing point from 98°C for sodium to 40°C for the alloy. This worsens the heat transfer properties, increases the cost and makes the problem of reaction with water and air more difficult.

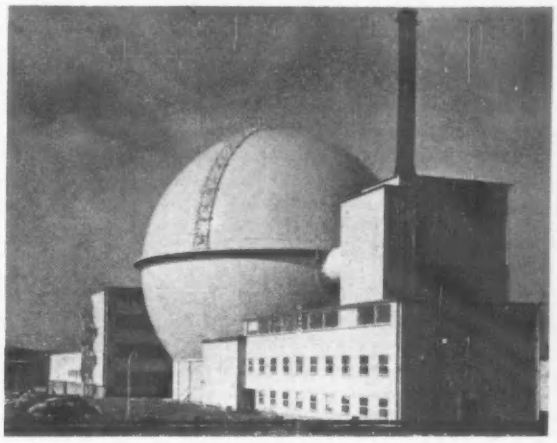


Fig. 1. A recent exterior photograph of the Dounreay fast reactor which was the subject of a symposium held last week

Control of the reactor is carried out by moving fuel in and out of the core.

Looking to the future nuclear power programme of the UK, the authors mention particularly that by 1970 there will be large stocks of plutonium available from graphite-moderated reactors. Since the fast-breeder reactors are efficient users of plutonium, they appear a suitable complementary type of plant to such thermal reactors. Dounreay is only an experimental project; it is thought "highly likely" that before a larger commercial fast reactor is built a prototype unit will have to be designed, built and operated. Formative stages of such a project have already begun.

Construction

The reactor contains 367 annular fuel elements composed of uranium, and 45% enriched uranium in a core measuring 21 in. diameter by 21 in. in height. The natural uranium breeder surrounds the core at the sides and top. The core is designed for a heat rating of 60 MW using sodium potassium alloy (NaK), but it is anticipated that this rating could be increased to 85 MW if sodium only is used for the coolant. Each fuel element is housed in an annular can with an outer sheath of 0·02 in. thick niobium and an inner sheath of 0·02 in. thick vanadium. The breeder actually consists of uranium plugs inserted in the top of the fuel elements and, in addition, a radial section of 2,000 uranium elements surrounding the core.

Reactivity can be controlled by moving 12 groups, each containing ten elements. By arranging for the groups

* The design, construction and commissioning of the Dounreay reactor was described in three papers by Messrs J. Tatlock, R. R. Matthews, J. L. Phillips and others. Two additional papers, outside the scope of this article, dealt with problems of reactor metallurgy and physics.

to be actuated from below, it is possible to control the reactivity during shut-down.

By using a vanadium internal canning material for the fuel element, directional control of the fuel is ensured if, owing to an excessive temperature being attained, the fuel melts. In such an eventuality the fuel would be guided, by the outer niobium can, into the specially designed base of the core.

Heat generated in the core is removed by circulating NaK alloy downwards, around and through the fuel elements. The coolant then enters primary heat exchangers outside the core, where the heat is transferred to a secondary circuit also containing NaK alloy. The secondary circuit incorporates alloy/water heat exchangers and, since it is essential to prevent any possibility of a leak developing between the alloy and water circuits, these heat exchangers have the water and alloy circuits in quite separate tubes. Heat transfer is effected through copper laminations brazed to the stainless steel circulating tubes. Steam from the secondary heat exchanger can be used to drive a conventional 15 MW, 150 lb/sq in. gauge, 270°C turbo-alternator.

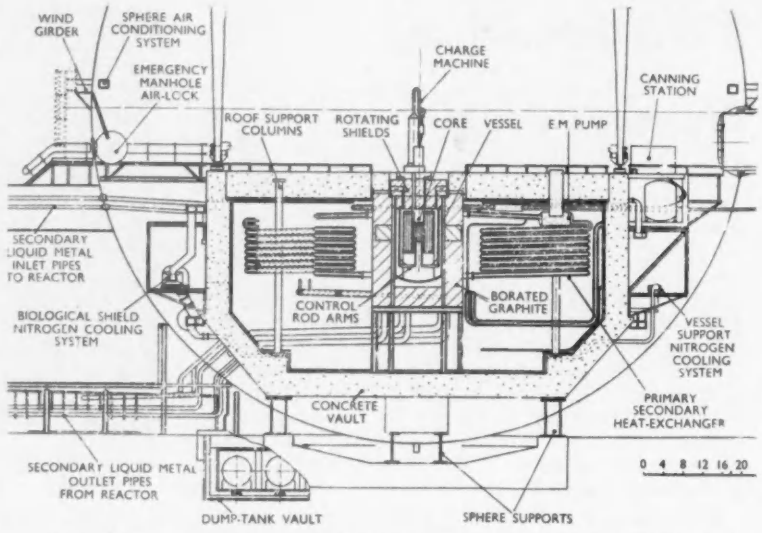


Fig. 2. General arrangement of the reactor. The heat exchanger and generator houses are omitted

The alloy coolant is circulated by electromagnetic pumps and, since these are completely lagged, the windings must withstand a hot spot temperature of 240°C, heat being removed only by the alloy coolant. The pumps are insulated with class "H" insulation and have specially developed inorganic insulation, anticipated to have a life of at least five years.

Altogether, there are 24 primary cooling circuits, each with one electromagnetic pump. The pumps are linear three-phase induction motors which circulate the alloy coolant by induced currents. Flow is controlled by varying the voltage applied to the pump stator winding. Similar pumps circulate the alloy in the secondary circuits.

To ensure efficient operation of the pumps, an inlet pressure of 12 lb/sq in. must be maintained. This pressure is ensured by a nitrogen gas blanket above the free surface of the alloy in the reactor vessel. The nitrogen gas also serves to prevent air coming into contact with the alloy coolant. It is of primary importance that the coolant circuits are maintained free of oxide, and one of the earliest difficulties with the reactor was caused by jamming of the control rod mechanism due to oxide accumulation on the moving parts.

The control rod mechanism is a U-shaped construction with one upright 14 ft long supporting a bottom arm. The upright contains a rotatable threaded shaft which causes the other upright to move vertically. This second upright supports the group of controlling fuel elements. Movement of the fuel group is caused by rotating the threaded shaft and it was due to formation of oxide film on this shaft that jamming occurred. The control rod mechanism is sealed to prevent nitrogen gas leakage. To obviate glands, an electromagnetic drive is used. This comprises a rotating electromagnet which transmits torque to an armature attached to the vertical rotating shaft, through a stainless steel diaphragm, which also provides the gas seal. Under emergency conditions, the control rod assembly can be dropped by de-energising a supporting electromagnet.

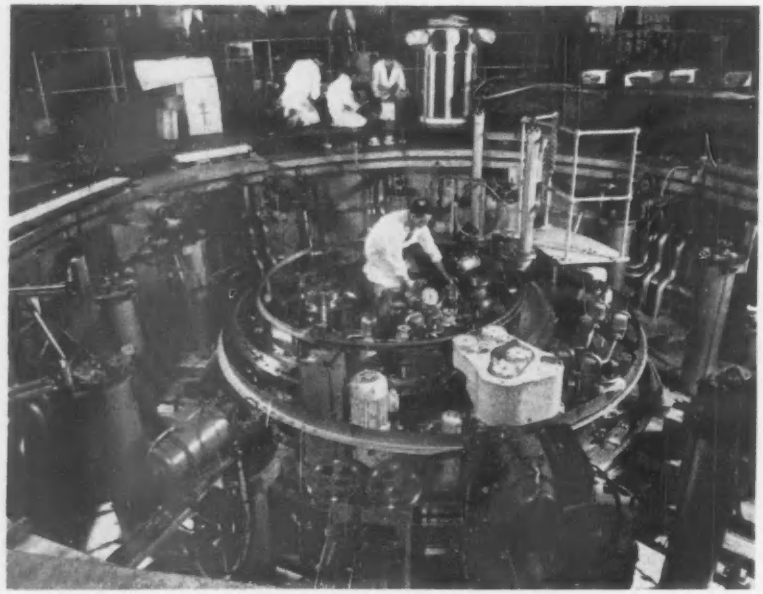


Fig. 3. Inside the pressure dome. The top of the stainless steel pressure vessel is visible in the reactor vault surrounded by the control rod and ion chamber operating gear

Returning to the problem of oxide removal, the first solution adopted at the design stage was to incorporate cold traps through which a quantity of the coolant could be circulated. During the subsequent construction it was decided that the limit of oxide reduction to ten part p.p.m. obtainable with cold traps was not good enough and hot traps were added. These incorporate a zirconium getter capable of lowering the oxide content to 5 p.p.m. The coolant is circulated through the getter at 600°C, the temperature being main-

tained by 35 kW electric heating elements each 6½ ft long.

Commissioning

Originally, construction was scheduled for completion in January, 1958, but the incorporation of hot traps and other modifications delayed completion to the end of 1958. However, testing was possible during part of this period and dry testing was completed in June, 1959, when the alloy was charged into the circuits. The reactor went critical in November and operated at zero energy for determining control parameters until the following April. It was then shut down for modifications to the core and to find ways of preventing gas entrainment in the coolant circuit. This difficulty occurs when the coolant flow reaches 70% of the rated value and has so far prevented full investigation of the cooling circuit characteristics. It is expected that the problem will be overcome early in the new year.

DISCUSSION

PROF W. B. HALL said the fast reactor had been studied for ten years and in that time there has been a shift of emphasis from its possible use as a plutonium breeder to a form with high rating and suitable for power production.

Rating	Fast reactor	Thermal reactor
Based on U235 kW/kg	286	500
Based on total U kW/kg	80	10
Based on reactor volume kW/cu ft	14,000	100

The table, above, suggests there is a factor of 140 for heat release/unit volume for the fast reactor compared with the thermal. Can an economic limit be set to increase of rating? One design problem for fuel elements is providing for much higher rates of heat release. Did the author's consider there are applications for liquid fuel? For example, elements which are allowed to melt towards the core thus imposing a less severe strain on canning materials. The heat flux at the surface of fuel elements is about 0·6 kW/sq cm and he thought the heat transfer problem had not been sufficiently emphasised in the paper; in the Dounreay reactor, heat transfer corresponded to a gradient of 3,000°C/cm. through stainless steel and 500°C across 1/1,000 in. of nitrogen gas. They are, therefore, well outside normal engineering practice.

Thermal stresses in liquid metal-cooled systems he thought are exaggerated. He would like to know the authors views? Professor Hall, commenting on the value of the electromagnetic pump, said the feeling was that they should be larger; would they then be more economical? He asked if stainless steel was better for oxide control than the vanadium and niobium canning materials used for the fuel elements. For example, it might make the omission of hot traps possible. He also asked the authors if, in their experience, the stringent inspection requirements mentioned in the paper could be eased on future reactors.

MAJ-GEN S. W. JOSLIN (ch. insp. MoP) while commenting on the excellence of the papers, offered the slight criticism that they gave little indication of lessons learned or experience gained on the experimental reactor. For example, the reasons originally given for using a 24 mulitple-circuit cooling arrangement was that only 4 in. rigs were available. The safety requirements were considered to be secondary. However, there were also 18 generator sets and it therefore seemed that safety considerations carried rather more weight than the paper implied. Referring to impurities in the cooling circuit he asked if the figure of five parts/million quoted had actually been achieved for oxide content and whether improved cleaning of the sodium potassium alloy from the control rods had been obtained after redesign.

PROF J. M. KAY said the Dounreay type of fast reactor (DFR) was inherently an unreasonable source of industrial power in its present form, because of the very small core size and the high heat rating which was necessary to obtain useful amounts of power. Referring to the size and rating of the core, for a larger power rating it would be necessary to dilute the core, but this would give an intermediate rather than a fast reactor. Was it possible to obtain a clear picture of the form which a prototype power-producing reactor might take? For example, would it have a larger core? Referring to burn-up he said there was no future in the fast reactor with metal fuels and asked what the prospects were for non-metallic fuels.

In reply, Mr Moore, referring to Professor Hall's questions, said there were great difficulties in optimising all forms of reactor and optimisation of the fast reactor was not yet understood, although in the last year a digital computor had made it possible to survey the parameters involved in a shorter period of time. A compromise was necessary between what the fuel elements could do and what was economical. The next step in the programme for DFR was to design an economical plant. Thermal efficiency was high, therefore the capital cost would probably be low, but it could vary with rating. Replying to General Joslin, he said many of the original design features would now be changed in the light of experience, certainly a modern design would not use 24 external cooling circuits. In the early days the melting problem was not fully understood and there was little knowledge of the behaviour of sodium. The construction used would certainly not be economical today and this was also true of the heat exchangers.

MR TATLOCK, also in reply, said he was in agreement with Professor Hall's table. Liquid fuels, he thought, would not be popular with the metallurgist and one difficulty would be the removal of fission products. Thermal stresses were exceedingly low except in fuel elements and it should be remembered that baffles were fitted to reduce thermal shocks.

MR MATTHEWS, in reply, said the electromagnetic pumps had proved to be very satisfactory. Consideration was being given to a prototype design for a 6,000 gall/min pump. One difficulty with the pumps was that they required thin stainless steel ducts and were, therefore, not very robust in large sizes. There was also the problem of heat removal from the windings. The pumps also had a low efficiency, only 40%, compared with the 75% to 80% for mechanical pumps. But at present they had no choice but to use the electromagnetic pump. There was quite definitely no relaxing of inspection requirements indicated by experience on the DFR. Value of the stringent requirements had been proved by the fact that no leak had been detected in the 18 months during which coolant had been in the reactor and it was certain that cost of leak repairs, especially in the primary circuit, would far outweigh inspection costs.

PROF C. R. TOTTLE, commenting on the suggested use of liquid fuel, said it must be remembered that the compatibility problem would be very much worse. It was true that sodium filled fuel was not desirable but there was at present no better solution available.

MR PHILLIPS said it was hoped that the gas entrainment problem would be solved early in the new year, there would then be a progressive increase in power output to June, then a rise to 15 MW to 20 MW by the end of 1961.

Dr Hurst, summing up the symposium, said that it seemed the trend of the discussion was to compare fast with thermal reactors. However, the fast reactor should always be regarded as complementary to the thermal reactor and not as its rival. The next step would be a prototype DFR then a civil reactor probably in the 1970's. Although the DFR might, at first sight, seem complex, there was greater freedom in geometry and fuel enrichment and the design was simpler and cleaner than for a thermal reactor. The materials problem was certainly among the most important and the most intractable.

Marine self-regulating alternators

by J. Griffin,* A.M.I.E.E.

PART 2

IT is the principal purpose of the present article to examine four self-regulating marine alternators currently available. In Part I, after a general consideration of the problem of self-regulation from its technical aspects, the L.S.E. "Altoreg" alternator system was described. Two further British systems and one Continental are described in this concluding part.

The Allen Self-regulating Alternator

In the Allen self-regulating alternator system, the alternator itself is of orthodox construction, but the conventional rotating exciter is replaced by a completely static excitation circuit in which shunt and series elements are so combined as to produce inherently a total excitation approximating, at all loads and power factors, to that required for constant alternator terminal voltage. The basic system is supplemented by an automatic "trimming" control to improve the inherent steady-state regulation to within the required closer limits.

The complete excitation and control schematic is shown in Fig. 5, from which it may be seen that a shunt transformer provides a nearly constant "no-load" or magnetising excitation component; an additional "on-load" component (inherently approximately correct in both magnitude and phase) is provided by a separate series transformer, the rectified output from the series-connected transformer secondaries being fed to the alternator field winding. Since the combination of the shunt and series components takes place on the a.c. side of the rectifier, the system is sensitive not only to the magnitude but also to the phase of the load current. The principle is thus that of phase-compensated load-current compounding, and the basic system alone is inherently capable of a steady-state regulation of about $\pm 5\%$ at all loads and power factors. A ballast reactor in the shunt circuit provides some measure of compensation for the resistance/temperature variations of the alternator field winding. The use of separate shunt and series transformers facilitates test-bed adjustment to suit the alternator or prime-mover characteristics, adjustable air-gaps being provided on the ballast reactor and the series transformer.

The inherent or "functional" control exercised by the basic circuit cannot in practice provide the extreme accuracy of voltage control normally required, and some sort of supplementary automatic trimming control is essential. The one provided is a simple automatic regulator of the static magnetic amplifier type, with a Zener diode bridge as the voltage reference. The regulator output current controls the impedance of a saturable control reactor connected in parallel with the ballast reactor, and the total impedance of the shunt circuit is thus varied slightly in response to any small voltage discrepancies detected by the regulator. For parallel operation a conventional quadrature-droop compensation signal (obtained in the usual way from a current-transformer-fed resistor)

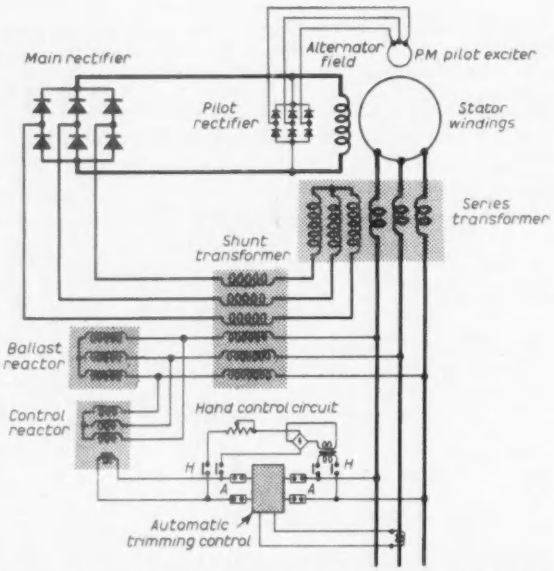


Fig. 5. Allen Self-regulating alternator system using a conventional alternator with static excitation equipment

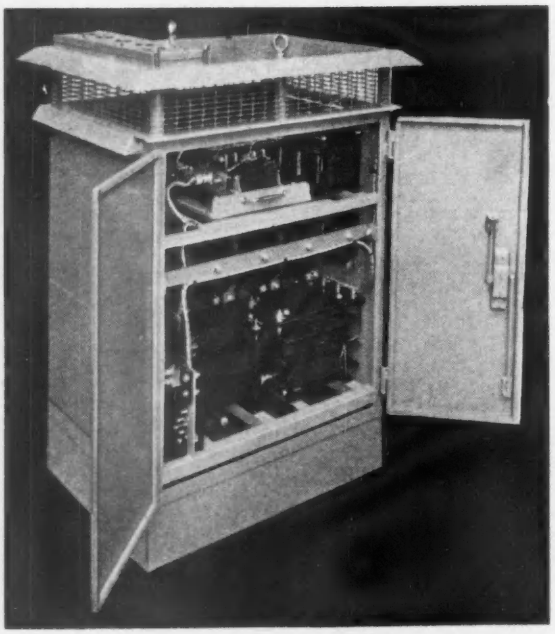


Fig. 6. Static excitation and control cubicle for 230 kW, 600 r.p.m. Allen diesel alternator

* Mr Griffin is with W. H. Allen, Sons & Co. Ltd. Part 1 of this article appeared on 8 December, page 877.

is introduced into the voltage circuit of the automatic trimming control. An alternative hand-control circuit, by-passing the automatic trimming control and comprising a small transformer and rectifier and a hand regulator, is provided for use in the event of trimming control failure.

Initial excitation is obtained from a small permanent-magnet pilot exciter through a pilot rectifier connected permanently in parallel with the main rectifier. The pilot system is designed to produce sufficient alternator terminal voltage to enable the main excitation circuit to become self-sustaining; in this instance the initiation is independent of the alternator residual voltage, no starting switch or relay is required, and during normal operation the exciter is blocked out of circuit by the pilot rectifier.

The manufacturers of this particular system prefer to supply the major excitation and control components in a separate self-ventilated cubicle. The alternator itself is of orthodox construction except for the absence of the usual main exciter, and the "initiative" pilot exciter is normally of the bearingless overhung-rotor type with its stator carried on a bracket on the bearing pedestal.

It is claimed for this system that in general the voltage dip and recovery time for a given impact load are both only about half those of a conventional alternator with an electro-mechanical a.v.r.; a transient voltage dip from no-load of only 12% with a low-power-factor impact load of 100% is said to be typical of four-pole turbo-alternators of about 400 kVA upwards, and the corresponding recovery time is about one-half of a second.

The G.E.C. "Accurex"

The GEC "Accurex" system is generally similar to that of the Allen alternator, and its principle of operation is again the static phase-compensated load-current compounding of an orthodox alternator with no rotating exciter. It differs from the Allen machine only in its use of a single "combining" transformer, in the method of excitation initiation, and in various more or less minor details.

The basic circuit schematic is shown in Fig. 7, from which it may be seen that the single alternator field winding is excited from a main rectifier which is in turn fed from the secondary winding of a "combining" transformer having two separate primary windings. One of these, the "shunt" primary, is fed from the alternator terminals through a saturable control reactor; the other, or "series" primary, carries the alternator output current. Once again, the shunt circuit provides an approximately constant "no-load" or "magnetising" excitation component, while the series circuit provides inherently an "on-load" component of the correct magnitude and phase to compensate approximately for the alternator armature reaction. The necessary combination of these two components is achieved by means of the transformer, whose secondary output is the vector combination of the two primary components.

As with the Allen system, the steady-state voltage regulation provided inherently by the basic circuit is

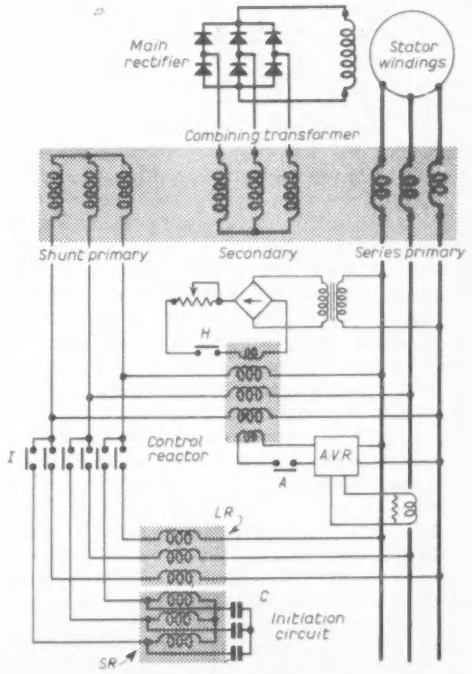


Fig. 7. GEC "Accurex" system

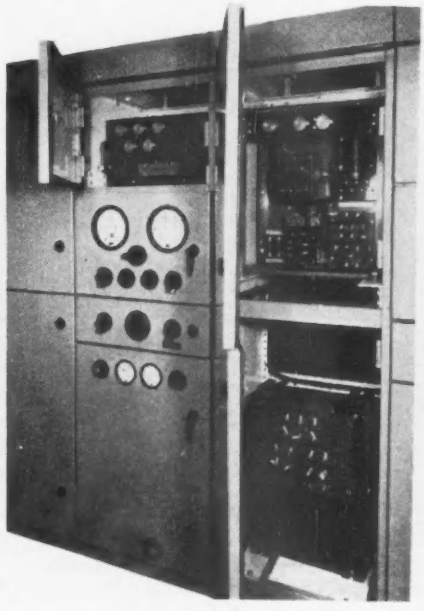
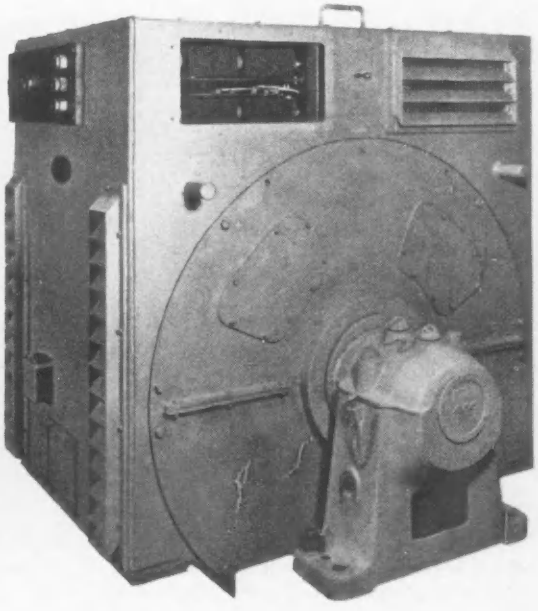


Fig. 8. 325 kVA 600 r.p.m. GEC "Accurex" alternator (extreme right) with machine-mounted rectifier and switchboard-mounted static excitation and control components (nearer illustration)



considered insufficiently accurate, and an automatic trimming control, again a static regulator of the magnetic amplifier type, is provided. The regulator output controls the impedance of the saturable control reactor (and hence the magnitude of the shunt excitation component) in response to any minor voltage variations. For parallel operation, conventional quadrature-droop compensation is provided, and a hand-control circuit (comprising a small constant-voltage transformer, a rectifier and a hand regulator, and feeding an alternative control winding on the saturable reactor) caters for the possibility of an automatic regulator failure.[8]

The method of excitation initiation now employed resembles that of the Siemens machine to be described later, but in addition to being only temporarily connected (by means of a hand-operated initiating switch or push-button) it also contains a voltage-limiting element. In the "initiative" connection a linear reactor LR, shunted by a capacitor C, provides an alternative feed to the "shunt" primary of the combining transformer. The reactor and the capacitor are arranged to resonate at the normal supply frequency, and the considerably increased voltage thus obtained from the relatively small alternator residual voltage is sufficient to initiate true self-excitation through the normal circuit. A saturating reactor SR is connected across the capacitor to limit the alternator voltage produced by the initiation circuit alone to about half the normal value.

The alternator to which this system is applied is of orthodox construction. In this instance, however, most of the excitation components are normally accommodated on the switchboard; a major exception is the main rectifier, which is mounted on the alternator itself and cooled by the alternator ventilating air.

The transient voltage response characteristics obtainable with this system are generally similar to those of the Allen alternator. A typical low-speed performance claimed is a transient voltage dip of only 18% with a low-power factor impact load of 100% on a 14-pole alternator, and the corresponding recovery time is about one-half of a second.

The Siemens "Constant-voltage" Alternator

The Siemens machine, typical of several generally similar Continental alternators, is probably the simplest of its kind currently available, and its principle of operation is again that of the wholly static phase-compensated load-current compounding of an exciterless but otherwise orthodox alternator. The circuit schematic is shown in Fig. 9, and it will be seen that the principal excitation components closely resemble those employed in the "Accurex" system; there is, however, no automatic trimming regulator.

The alternator field winding is excited from a rectifier, which is in turn fed from the secondary winding of a combining transformer with two primary windings. One of these the "shunt" primary, is fed from the alternator terminals via a "magnetising" reactor; the second, or "series" primary, carries the alternator output current, and the now familiar pattern of a constant "no-load" component supplemented by a variable "on-load" compensation component is thus repeated.

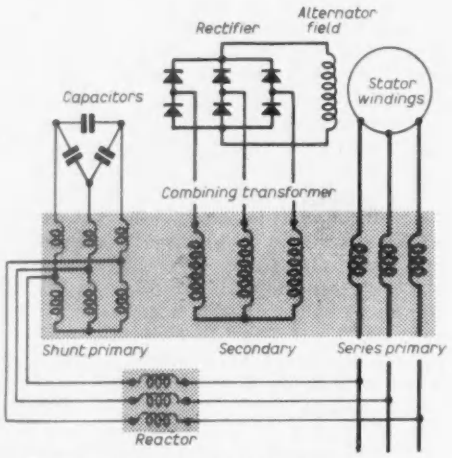


Fig. 9. Siemens "Constant-voltage" alternator system

The major part of the shunt primary is itself shunted by a capacitor connected via a second section of the winding. This capacitor, which at normal frequency is approximately resonant with the magnetising reactor, provides inherent compensation for the resistance/temperature characteristic of the field winding,[9] and it also plays a part in the excitation initiation.

As has already been mentioned, the principal difference between this system and that of the "Accurex" is that in this instance no form of automatic regulator is employed: the system is thus wholly "functional." In practice, not even hand regulation is provided, and any necessary adjustment is by means of reactor and transformer tappings and by means of a variable air-gap on the

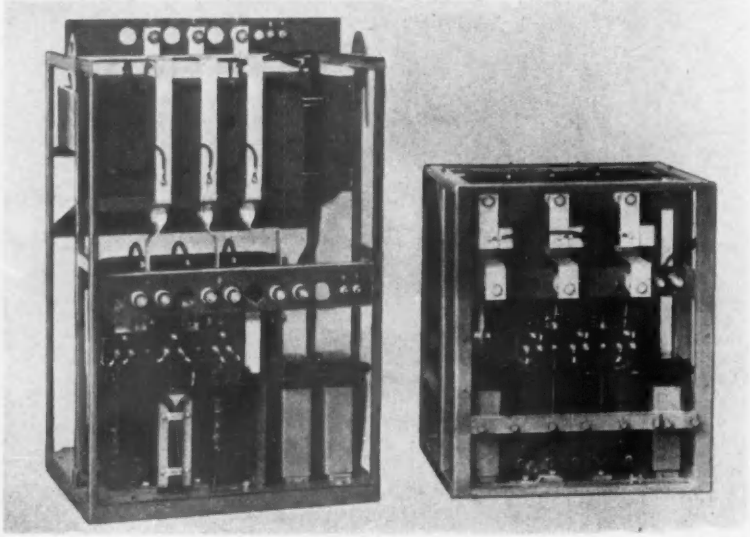


Fig. 10. Alternative static excitation units for 450 kVA 1,200 r.p.m. Siemens "Constant-voltage" alternator, with (left) selenium and (right) silicon rectifiers

[8] A further "negative-bias" control winding (not shown in Fig. 7) is fed from the main field rectifier through a preset resistor; its function is to produce an inherent voltage droop to facilitate parallel operation when under hand control.

[9] In the idealised circuit comprising the magnetising reactor in series with the parallel combination of the field winding and the capacitor, the current through the field winding is independent of its resistance.

magnetising reactor. The steady-state voltage regulation is nevertheless claimed to be within the Classification Societies' usual $\pm 2\frac{1}{2}\%$ at all normal loads and at power factors between unity and 0·8 lagging; because, however, of the purely functional nature of the system the voltage regulation is naturally dependent on the maintenance of a consistent prime-mover speed/load characteristic.

Parallel operation inevitably presents a problem in any purely functional system, since the a.v.r. is no longer available as a convenient vehicle for low-power compensation. Although the system itself can sometimes be so designed as to provide inherently the required voltage droop with increasing reactive load, more positive measures are desirable as a precaution against minor differences in machine or prime-mover characteristics. The method adopted for the Siemens machine is analogous to that usually employed for compound-wound d.c. generators. Each alternator field winding is connected, through a special double-pole contactor controlled by an auxiliary contact on the main circuit-breaker, to a pair of "equaliser" busbars. A tendency for one machine to take more than its proper share of the reactive load would normally be accompanied by a corresponding increase in its field current; but any such excitation inequality is inherently prevented by the parallel connection of the field windings, and given satisfactory prime-mover characteristics stable operation is thus assured. For exactly similar machines the field windings may be connected directly to the equaliser busbars, but with unlike machines some sort of potential divider arrangement is presumably necessary.

As in the "Accurex" system, a resonant circuit is responsible for excitation initiation, but with the Siemens machine the necessary capacitor is permanently connected and no additional components are introduced. As has already been mentioned, a capacitor tuned to resonance with the magnetising reactor at normal frequency is effectively in parallel with the field winding via the rectifier; the resulting amplification of the alternator residual voltage is sufficient to overcome the "threshold" forward voltage drop of the rectifier, and thus to initiate self-excitation.

In this system the alternator itself is of orthodox construction and the static excitation and control components are normally supplied in a self-ventilated skeleton-frame cubicle designed for incorporation in the main switchboard. Since switchboard space is always at a premium it is interesting to note that silicon rectifiers are now normally offered in place of the older selenium type.

In respect of the initial voltage dip the transient voltage performance of the Siemens system is generally similar to that of the other machines already considered, and a dip of 21% with a 0·5 power factor impact load of 150% on a 210 kVA six-pole alternator is quoted as typical. In respect of response time, however, the performance of the Siemens machine is apparently a good deal better than that so far claimed for any British machine, and recovery times of the order of a tenth of a second from impact loads in the 50% to 150% range at normal induction-motor-starting power factors are shown in a number of published oscillograms. In this respect, the absence from any of the British machines of a permanently connected resonant circuit may not be without some significance.

Acknowledgments

The author is indebted to the following organisations for their ready co-operation: to Laurence, Scott and Electromotors Ltd. for information about their "Altoreg" system and for Fig. 4; to the General Electric Co. Ltd. for information about their "Accurex" system and for Fig. 8; to Siemens-Schuckert (Great Britain) Ltd. for information about their parent company's "Constant Voltage" alternator and for Fig. 10; and to several other organisations for the provision of material which it proved impossible to include. He wishes also to thank the directors of Messrs W. H. Allen Sons and Co. Ltd. for Fig. 6 and for permission to publish this article.

(Concluded)

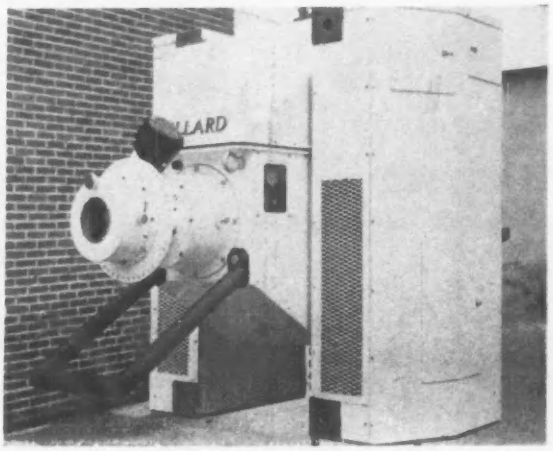
Mobile Linear Accelerator

CLAIMED to be the first mobile linear accelerator in the world, a 4·3 MeV unit for X-ray examination of nuclear power station pressure vessels has been delivered by Mullards to the UKAEA. The units give a radiation intensity of over 600 rontgens/minute at a distance of 1 metre from the X-ray source, with a focal spot less than 2 mm in diameter.

With the equipment it will be possible to obtain a radiograph through 4 in. thick steel in as little as four seconds. For 12 in. steel, exposure would be less than nine minutes. One of the advantages claimed for the unit in terms of construction site use is the absence of very high voltages. The entire accelerating process on the injected electrons is carried out in a length of 1 metre, in which electrons attain a speed of 99·5% of that of light.

The unit is self-contained and measures 8 ft 9in. long by 4ft 9in. wide by 5 ft high. It weighs about two tons and can be rotated about both horizontal and vertical axes. Vacuum and cooling systems have been incorporated within the unit so that external hose connections are unnecessary. Ancillary electrical and control equipment is housed in a transportable, weatherproof structure of fibreglass which may be sited up to 250 ft away from the accelerator. First use for the accelerator is scheduled to be the CEGB's Trawsfynydd nuclear power station.

An alternative to the linear accelerator, still avoiding the use of high voltages on construction sites, might be a cobalt-60 radio-isotope source. Advantage claimed for the accelerator against such a source is that it permits radiographs of high definition to be obtained much faster for the thickness of metal likely to be encountered in nuclear power station applications.



The 4·3 MeV linear accelerator in suspended position

Turbine and compressor production

NEW FACTORY WITH ACCENT ON EXPORTS

ANTICIPATING a growth in demand for gas and steam turbines and compressors, the Hawker-Siddeley Brush group decided in 1958 to concentrate their production at a single new factory. Last week, representatives of the Press were able to see what has been achieved at the factory in the last two years.

The Press visit was on the first of three open days. Welcoming representatives, Mr G. B. R. Feilden, M.A., M.I.MECH.E., F.R.S., the managing director, expressed the opinion that in the next few years turbines and rotary compressors would find many hitherto untried applications, particularly in chemical engineering.

The new factory was, until recently, used by the aircraft industry and, in fact, the last aircraft left only in February this year. It is at Hucclecote, in the Cotswold Hills, but conveniently near to both Gloucester and Cheltenham. The floor area of 200,000 sq ft allows a fairly spacious factory layout, and the careful planning in evidence was furthered in the design stage by the use of models. The factory has a staff of 700 employees and includes key personnel transferred from the Loughborough works.

Hawker-Siddeley Brush Turbines was formed in 1959 to carry out the manufacture of steam, gas and gas-expansion turbines as well as compressors and turbo-chargers. These were previously the concern of the Brush Group. It will be recalled that the Brush Group was acquired by Hawker-Siddeley in 1957. The Brush Group had a long association with steam turbine design dating back to 1910, when they began manufacture of radial-flow turbines. In 1946, their range was extended to include axial-flow impulse industrial turbines. In common with other manufacturers, they turned their attention in 1948 to the industrial gas turbine, and these they now produce under licence from the US firm of Clark Bros. At about the same time, they also introduced their standard range of turbo-chargers for diesel engines. More recently, they have developed the gas-expansion turbine to utilise the gas output from free-piston gasifyers.

Steam Turbines

The two types of turbine manufactured at Hucclecote are in the intermediate rating range up to about 30 MW. The radial-flow turbine has for a long time held an established place in generation. It has concentric sets of blades with alternate rings coupled and driving two alternators mounted at either end of the machine. These alternators are permanently connected in parallel. The design has several advantages—for example, the casing is never in contact with high-pressure steam and start-up can be rapid. But it also has certain limitations for use in an integrated thermal system. For this reason the company introduced their axial-flow design and these machines are available for condensing, non-condensing and back-pressure installations. A feature of their construction is the use of vortex-shaped blades where this refinement is warranted by the blade length used.

The factory includes comprehensive development and materials-inspecting laboratories and test facilities. For steam turbine testing, a Yarrow oil-fired water tube boiler

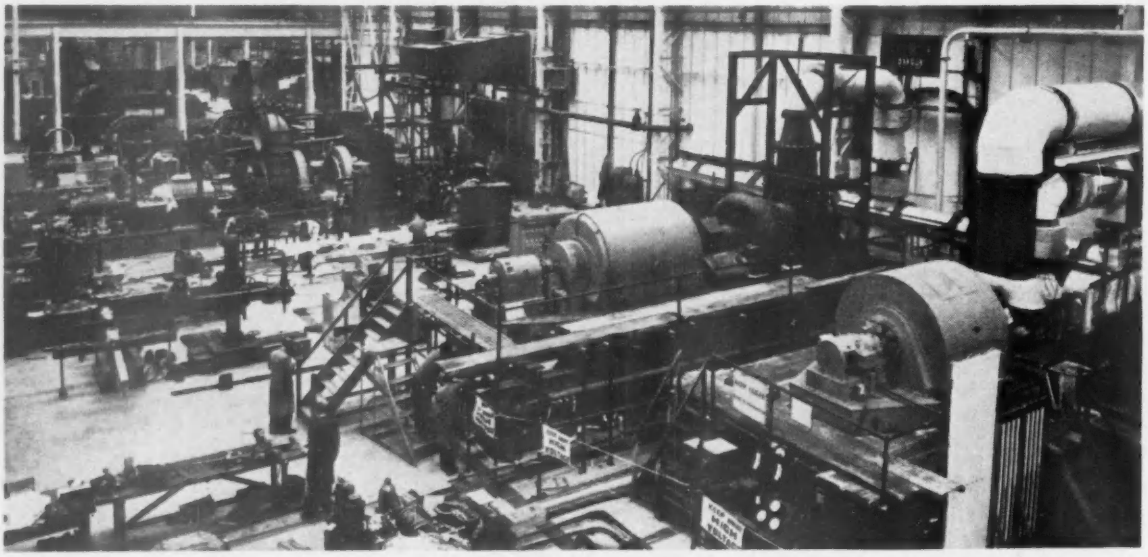


Fig. 1. The turbine erection and test area in the new Hawker-Siddeley Brush Turbine's factory at Hucclecote. On the right are the steam and gas expansion turbine test beds with access to a steam main and the gas main fed from four free piston gasifyers. A Clark gas turbine in course of erection can be seen in the background

is installed with a capacity of 80 klb/hr at 400 lb/sq in., 700°F. This enables turbines to be mechanically proved and, where electrical testing is also required, a load tank allows dissipation up to 5 MW. A permanent condenser is installed, but machines can also be tested with their own condensers operating in conjunction with a 270,000 gal/hr "Film" induced-draught cooling tower.

Gas Turbines

The Clark gas turbines, made under licence, are rated between 8,700 h.p. and 9,000 h.p. The two types being manufactured are suitable for pump or compressor drives and power generation, respectively. The turbines have two h.p. and l.p. stages and are open-cycle machines which may, however, be either regenerative or non-regenerative. The complete turbine and compressor unit is mounted on a single bed plate. Air is compressed in a 13-stage axial compressor and passes to a single combustion chamber mounted above the compressor. The hot gases from the combustion chamber pass through ducting to the gas turbine and may then be used for steam generation before exhausting to atmosphere.

Two test beds for these machines can each handle machines rated up to 10,000 h.p. Air intake is through a chimney 45 ft high and two further chimneys carry away the exhaust gases. The test beds are also equipped with Heenan and Froude dynamometers capable of absorbing 11,500 h.p. at 3,000 r.p.m.

Gas-expansion Turbines

The gas-expansion turbines, depending on their rating, are designed to operate with either single- or multiple-unit gasifyers of the free-piston type. Multiple gasifyer installations enable turbine powers from 1,000 to 10,000 h.p. to be obtained. The turbines have benefited from work on high-speed and temperature operation by the company on their range of steam turbines. The expansion turbines have high efficiency and incorporate reaction-type vortex blading. A solid forged rotor is used, with internal heating facilities to permit rapid start-up, and a pressure-balancing system is used to reduce end thrust on the bearings.

For testing the expansion turbines, four free-piston gasifyers are provided, each with a rating of 1,250 gas h.p. These feed into a common duct and provide sufficient gas for mechanical proving tests on machines rated up to 10,000 h.p. The gas supply is at 51·3 lb/sq in. average and 825°F. Because of the pulsating nature of the gas output from the gasifyers, flow measurements are made by a venturi exhaust chimney into which the turbine exhaust gases are discharged.

Turbo-chargers

The manufacture of turbo-chargers for diesel engines forms an important part of the factory output and is at present running at the rate of ten units per week. The range covers 350 h.p. to 5,000 h.p. and the chargers have a single-stage centrifugal compressor driven by an axial-flow turbine exhausting to atmosphere. Four test cells are provided with a combustion chamber room running the full length of the test bay. There is also a compressor test rig with a rating of 350 h.p. Under test, the turbo-chargers are operated as self-driving gas turbine units with a combustion chamber interposed between the compressor delivery and turbine inlet.

Compressor characteristics for the smaller frame sizes of turbo-charger are obtained by using the 350 h.p. compressor test rig. For the larger size units, the characteristics are determined by using power gas from the free-piston gasifyer installation.

In addition to the production test cells, two turbo-charger cells are available for development purposes. In these cells, experience has been obtained with turbo-chargers operating with a 3:1 compression ratio and with turbine inlet temperatures up to 700°C.

Research and Development

Research and development facilities have received much attention. The mechanical laboratory is fully equipped for the testing of design features before incorporation in products. The test equipment includes a 40 g.p.m. pump for the development of hydraulic control systems with pressure control up to 200 lb/sq in. and provision for temperature variation.

Ovens are available for experimental work on hot components and a pneumatic test section has been provided to enable investigations to be made on high temperature steam and gas valves which are subject to continuous vibration under working conditions.

The vibrations laboratory is equipped with electronic measuring instruments for vibration analysis on turbine blades and components. Special equipment has been developed for the continuous monitoring of vibration, displacement or other features of a turbine installation in service. This equipment can be used to give warning of excessive vibration levels or to shut down a machine if required.

An important part of the work of vibrations laboratory is checking blades and discs for resonant vibration modes likely to occur under running conditions. Vibrators are also installed for investigating casing vibration problems capable of exerting a force of ±500 lb.

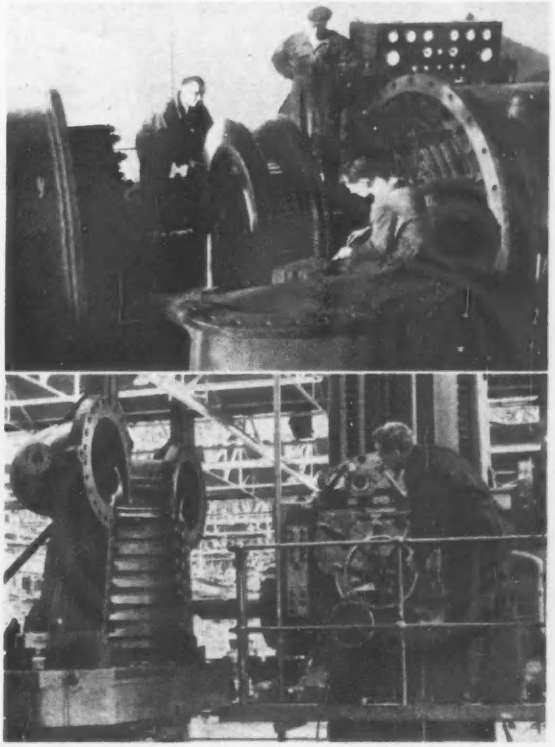


Fig. 2. In the top picture, fitters check the blading clearances on a 20 MW radial-flow, double-rotation, steam turbine. The lower illustration shows a milling operation on the joint base for a 6 MW gas turbine

OVERSEAS NEWS

from our correspondents abroad

CANADA

Columbia Project Finance

In the speech from the throne, the Federal Government indicated that Parliament will be asked to provide money for the Columbia River Hydro-electric Development, estimated at more than $450 million. This is by far the largest of three vast public works projects in Western Canada. The speech also suggested that the Government had come to a decision on the $60 million rail extension to Pine Point and that it is prepared to proceed on a $80 million flood protection plan for Winnipeg.

U.S.A.

Anti-trust Law Indictment

Charges of violating the anti-trust laws have been preferred against 19 of America's largest manufacturers of electrical equipment. All but one of the defendants have offered pleas of guilty, or say they do not wish to contend the charges. The case opened on 8 Dec. and concerns annual sales estimated at £717 million, mainly to Government departments and industrial concerns. Westinghouse is named in 20 indictments and has pleaded guilty to seven, General Electric have pleaded guilty to six of their 19 indictments. Counsel for the companies say the pleas are offered, not in admission of all the indictment allegations, but to terminate what would otherwise be a long and expensive litigation.

BRITISH GUIANA

Government Acquisition

Reports indicate that the British Guiana Government White Paper shows their intention to take over the Canadian-owned Demerara Electric Co. before the end of the year. The White Paper pledges the Government to continue extension of the electricity system as far and quickly as practicable into the Colony's rural areas. It also calls for a full investigation of the hydro-electric resources. The estimated purchase price for the undertaking is $6 million BWI. The Government proposals also provide for revision of industrial rates

SWEDEN

More Hydro-power for Sweden

Recently a preliminary regional plan for building three hydro-electric stations with an annual output of 2,600 million kWh was presented to the Swedish State Power Board. Total cost of the scheme is estimated at £45 million, excluding transmission lines, and it is planned for completion after 1970. The stations will be erected on the upper reaches of the Stora Lule River in Arctic Sweden. This river constitutes Sweden's largest remaining power resource with a potential of over 16,000 million kWh, or nearly one-fifth of Sweden's overall power resources. Plans are already in hand to utilise 14,000 million kWh of this capacity and 3,600 million kWh are already in service through three stations. The plan envisages three power plants at Vietas, Ritsem and Voujat with heads varying from 78 to 163 metres.

European Power Exchange

Sweden intends to join the electricity power exchange scheme which already has a number of the OEEC countries as participants. By joining the scheme Sweden will benefit from seasonal and occasional power, especially from countries where electricity is generated by thermal plants. At present only about 40% of Sweden's economically usable water power is exploited even though she is one of the world's major consumers, with consumption per head of more than 4 MWh a year.

POLAND

Polish Exports to India

Motors and control equipment exported by Poland to India over the last year amounted to 400,000 foreign currency zlotys. Agreements for further supplies valued at 300,000 zlotys and also for 360,000 zlotys worth of electric meters have also been signed.

GREECE

Hydro Plant Construction

Work began recently on the new Tavropos hydro-electric station. As reported in ELECTRICAL TIMES for 27 Oct., this scheme forms one of three important power projects for long-term development of Greek hydro resources which have been inaugurated this year. The Tavropos station in the Karditsa mountains will initially have two 40 MW generators and a third will be brought into service during 1962. Studies are also being undertaken for two further hydro projects in Macedonia on the rivers Nestos and Aliakmon.

S. AFRICA

Commissioning at Athlone

The first of six 30 MW turbo alternators at the Cape Town Athlone power station was completed at the end of October and was put on the bars in mid-November. The second of the two 284 ft high cooling towers has also reached its full height and now awaits the cooling equipment. It is not expected that the Athlone station will be generating continuously until next March when the second set is planned for commissioning.

Power Station Contracts

Contracts for the first stage of the Rooiwal power station have been awarded to A. Reyrolle for 132 kV switchgear at the fixed price of £293,453 and to English Electric Co., of SA, for 132 kV transformers at the fixed price of £189,816.

NYASALAND

Nkula Falls Project

Work may begin within the year on the first stage of the £3 million Nkula Falls hydro-electric scheme. The scheme includes a 420 ft barrage at Liwonde and a power station with 28 MW generators. A transmission line from Blantyre to Limbe will also be needed.

ZANZIBAR

Supply in Zanzibar

Although there was a falling off in trade, the annual report for the Electricity Board of Zanzibar for the year ended 31 Dec., 1959, shows a 9% rise in units generated to 9·4 million. To meet interests on the main loan it was found necessary to increase rates during the last two months of the year. Towards the end of the year a loan of £100,000 was secured for purchasing new generating sets at Saateni station and these were ordered in January, 1960. The generating capacity totals 2·9 MW of diesel plant.

UGANDA

Rural Expert's Visit

A recent visitor to Uganda was Mr Finn-Kelcey, of ERA, who is investigating the uses of electric crop drying applied to local produce. He is also visiting a number of other African territories.

INDIA

Tenders for Power Station

Tenders are invited from consultants able to undertake the design, installation, erection and commissioning of the first stage of an 84 MW natural gas thermal power station at Namrup in Assam. The station is initially to have four 16·8 MW turbo-alternators. Exhaust steam boilers will provide process steam for an adjacent factory. A 66 kV transmission system extending for 200 miles is included in the requirements. Tenders, to be submitted by 23 Dec., 1960, may be in two parts, (1) for the comparison of bids, preparation of specifications and drawings, and (2) supervision of erection and commissioning. Tenders to be sent to M. R. Sita Ram, Additional Chief Engineer (Elec.), Assam State Electricity Board, Lachumiere, Chittagong.

Replanning the Plan

The Government of India hopes to eliminate two sources of weakness in the Third Plan which have become apparent as the result of experience in the first two Plan periods. The first two Plans failed to take account of maintenance requirements, not only for many of the non-plan projects but also for some of those included in the plans. The Government had found that, in general, countries offering financial assistance were reluctant to assist with maintenance schemes. The second deficiency in the economic development plans stems from insufficient emphasis on power, mining and transport requirements. Even though power equipment and mining schemes have figured in almost every credit recently negotiated, industrial development has been so rapid that even in the Bhakra area the output from the new station is urgently required.

Repeat Order for Ahmedabad

A repeat order for a 30 MW generator set has been placed by the Ahmedabad Electricity Co. before the first set is installed. The first set is scheduled for commissioning in March, 1962, and by placing the repeat order now it is hoped that additional power capacity will be available by March, 1963. That there may be scope for even further expansion in generating capacity was stated by the chairman of the company when he announced the repeat order. The Gujarat Electricity Board have sanctioned the new expansion and the company have signed an agreement with the Development Loan Fund for $3·9 million to cover the foreign exchange for the new plant. The turbine boiler and ancillary plant is being supplied by AEI Export, Babcock and Wilcox and Strachan and Henshaw. The annual report of the Ahmedabad Co. for the year ended 31 March, 1960, shows a 1·2% rise in unit sales over the previous year to 698·2 million. The gross profit for the year was Rs 78·4 lakhs.

PAKISTAN

Rural Electrification Programme

It was recently announced that the West Pakistan WAPDA will undertake electrification of 8,750 villages in the future at a cost of Rs32·5 crores 5,000 villages will be financed by the Development Loan Fund and the remaining 3,750 by the National Zonal Funds. The new plan actually covers electrification of all the 40,000 villages in the country at the rate of 1,000 a year. Already about 300 villages have been electrified. For the 8,750 villages to be electrified in the near future, consumption is estimated at 30 MW with a value for each village of about 50 kW. The cost of electrification for one village is estimated at Rs1 lakh.

Fresh Loan Sought for Karachi

To finance a power project, which is likely to come into operation in 1965, the Karachi Electric Supply Corporation will seek fresh loans. This was announced recently by Mr A. G. Khan when he presented his report for the year 1959. In the immediate future, the Corporation hope to augment generation by 15 MW in January next and a 60 MW extension to the "B" station is planned for commissioning in 1962. Present generation capacity is 53·9 MW and, as recently reported, rapid growth and demand has recently made load shedding unavoidable. Last year, power consumption rose to 15·95 crore units of which 70·13% was for industrial use. Energy sales also rose to 27·53 crore units. The Corporation's revenue for the year rose by 14% to Rs3·20 crores and profits also rose by nearly 18% to Rs32·36 lakhs.

Electrical Factory in Karachi

Next year, Siemens (Pakistan) Engineering Co. plan to establish a Rs20 million manufacturing plant for motors and transformers. The plant is expected to produce more than 10,000 motors and 2,300 transformers/year.

JAPAN

Overseas Bid Surprise

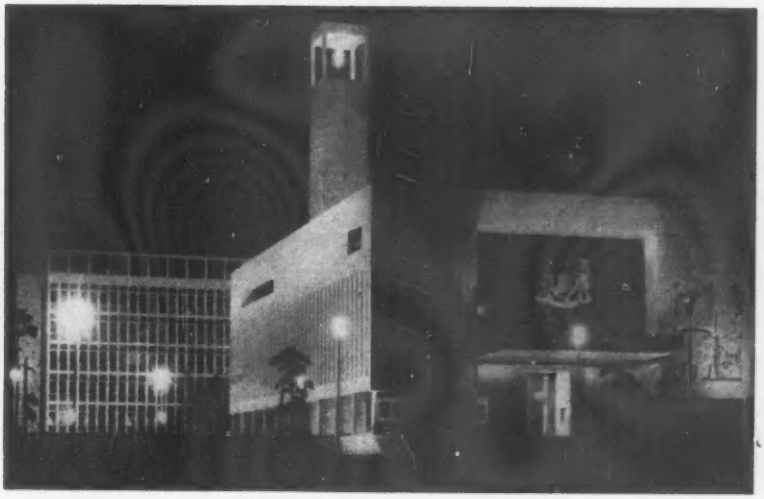
Announcement that the Tokyo Electric Power Co. is planning to buy new thermal electric generating plant through international bidding has caused surprise among Japanese electrical manufacturing firms. The president of the company said bidding would start next April and international purchase was essential because of the company's increasingly heavy financial burden. Tokyo Electric Power have advanced by five years their capital investment programme for 1959-75 and are concentrating on construction of more thermal power plants at the expense of hydro-electric generation. The president also said that construction work on the proposed nuclear power reactor must begin in 1963.

PARLIAMENTARY LIGHTING

Modern lighting techniques enhance the appearance of the new Uganda Parliament buildings at Kampala by night. The 180 ft tower dominating the main building houses a lantern comprising four 5 ft 80 W fluorescent lamps.

The installation by AEI Lamp and Lighting also includes floodlights for the parade ground and gardens, and special types, housed in stainless steel spinnings, illuminate the gilded Royal Crest over the main entrance. The Council Chamber, contained in the centre of the building, is illuminated by artificial lighting derived from a series of trough fluorescent fittings built into the ceiling. The lamps have colour temperature 3,500°K and are maintained from the roof space.

Supplementary lighting for press and public galleries comes from tungsten wall brackets. A colourful mosaic dome, illuminated by a beaten copper lighting fitting in the form of a sun and containing filament lamps, forms the ceiling of the Chamber entrance lobby



NOTES ON WIRING

BY MEGOHM

EVERYBODY in the electrical contracting industry appears to be busy at the moment, some rather busier than others, but with enough work to go round. From this fact one assumes that installations of all sizes are going ahead and that people are really becoming electrically minded. The creation of smokeless zones mean that more people are turning to electricity for heating their homes and we now see the results of the extensive campaigns to make people become entirely "electric" in their homes. I still retain a coal fire in my lounge but for all other heating, water heating and cooking I rely on electricity. I always had the comforting thought that if my coal merchant failed to deliver my fuel I could use my electric fire.

As a result, like many others, I received rather a shock last week through the medium of the London evening newspapers, when I read that there were fears that the generating stations might not be able to handle any great increase in load if we get a really cold winter! The statement read that warnings about this had already gone out to those in authority. To those in the industry the threat is softened to some extent by our knowledge of the extent to which, even if demand does approach the limits set by generating capacity (and transmission capacity, as we are reminded during "amenity" enquiries), a significant amount of load can be shed by reduction of voltage and frequency. A drop in illumination levels, however undesirable, is better than no heat.

On the surface, this situation may not appear to be serious, but I feel that it is. Of course, if supply interruptions came back, they could undermine the confidence of the public in the electrical industry. What value has dust-free heating, clear lighting and the dozens of labour-saving electric devices if the operating power is not readily available at all times? After reading the newspaper reports, I sat in the train and listened to my fellow-travellers' comments. Many of them were just getting over a high-powered attack on their homes by one manufacturer of electrical goods. This subject may not appear to be directly connected with my normal writings but one contractor has already informed me that the public have noted the matter and are looking to other forms of heating "just in case" they suffer from "power cuts."

M.I.C.S. Cables

My recent remarks about m.i.c.s. cables and their uses in boiler houses brought me some interesting comments. One engineer asked me if I had ever experienced trouble where I had had the m.i.c.s. cable taken right into a magnetic valve. I gave a lot of thought to this question and replied firmly in the negative. I had in mind one particular installation where over a dozen such valves are installed and I know that they are all functioning. This engineer then went on to explain that such valves had given trouble some years back and after careful investigation the blame eventually fell on the m.i.c.s. cable. The explanation was that voltage surges occur during certain operations of these valves and the cable breaks down.

This may well explain the fact that many engineers specify that m.i.c.s. cable must terminate short of the valve and require the connection to be made in some other form of cable. Personally, I have never had any such trouble, although I have taken precautions in other situations to prevent damage to m.i.c.s. cable by voltage surges. Of course, it is an easy matter to protect m.i.c.s. cable against such damage, and I feel that the manufacturers of such valves might be approached on the matter, for m.i.c.s. cables have always proved themselves beyond question where resistance to heat, etc., is required.

Warning

May I once more appeal to all electrical engineers to cast their eyes over their friends' "temporary wiring" for their Christmas tree lights, etc? I know that it is a difficult thing to do but often well worth the possible offence caused. I was partaking of a glass of cheer in a hostelry recently and noticed that the lady behind the bar grimaced every time she had to reach past a small artificial tree gaily decorated with lights. When I asked her what the trouble was I was told that the tree seemed to scratch her arm. On looking a little closer I saw that the flexible of the decoration set was perished and bare in places and that the lady was actually placing one hand on a sink whilst she reached through, or past, the tree. A few words of explanation to the landlord and the lights were disconnected. These decoration sets of lamps are, apparently, unearthed every festive season and hung on the tree, any bare patches in the wire being covered by sticking plaster. I feel certain that better care will be taken of them now.

Lamps and Fuses

Two rather revolutionary lamps have made their appearance on the market. Both are rated at 60 watt and are designed to eliminate the use of glass shades on fittings. Two shapes are available and I find them rather pleasing to the eye even when used in fittings designed for glass shades. The idea is excellent in my opinion, and although the price of the lamp is about 12s 6d I can see many people using it. For corridors and very small rooms they should prove invaluable.

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NOTES ON WIRING

BY MEGOHM

EVERYBODY in the electrical contracting industry appears to be busy at the moment, some rather busier than others, but with enough work to go round. From this fact one assumes that installations of all sizes are going ahead and that people are really becoming electrically minded. The creation of smokeless zones mean that more people are turning to electricity for heating their homes and we now see the results of the extensive campaigns to make people become entirely "electric" in their homes. I still retain a coal fire in my lounge but for all other heating, water heating and cooking I rely on electricity. I always had the comforting thought that if my coal merchant failed to deliver my fuel I could use my electric fire.

As a result, like many others, I received rather a shock last week through the medium of the London evening newspapers, when I read that there were fears that the generating stations might not be able to handle any great increase in load if we get a really cold winter! The statement read that warnings about this had already gone out to those in authority. To those in the industry the threat is softened to some extent by our knowledge of the extent to which, even if demand does approach the limits set by generating capacity (and transmission capacity, as we are reminded during "amenity" enquiries), a significant amount of load can be shed by reduction of voltage and frequency. A drop in illumination levels, however undesirable, is better than no heat.

On the surface, this situation may not appear to be serious, but I feel that it is. Of course, if supply interruptions came back, they could undermine the confidence of the public in the electrical industry. What value has dust-free heating, clear lighting and the dozens of labour-saving electric devices if the operating power is not readily available at all times? After reading the newspaper reports, I sat in the train and listened to my fellow-travellers' comments. Many of them were just getting over a high-powered attack on their homes by one manufacturer of electrical goods. This subject may not appear to be directly connected with my normal writings but one contractor has already informed me that the public have noted the matter and are looking to other forms of heating "just in case" they suffer from "power cuts."

M.I.C.S. Cables

My recent remarks about m.i.c.s. cables and their uses in boiler houses brought me some interesting comments. One engineer asked me if I had ever experienced trouble where I had had the m.i.c.s. cable taken right into a magnetic valve. I gave a lot of thought to this question and replied firmly in the negative. I had in mind one particular installation where over a dozen such valves are installed and I know that they are all functioning. This engineer then went on to explain that such valves had given trouble some years back and after careful investigation the blame eventually fell on the m.i.c.s. cable. The explanation was that voltage surges occur during certain operations of these valves and the cable breaks down.

This may well explain the fact that many engineers specify that m.i.c.s. cable must terminate short of the valve and require the connection to be made in some other form of cable. Personally, I have never had any such trouble, although I have taken precautions in other situations to prevent damage to m.i.c.s. cable by voltage surges. Of course, it is an easy matter to protect m.i.c.s. cable against such damage, and I feel that the manufacturers of such valves might be approached on the matter, for m.i.c.s. cables have always proved themselves beyond question where resistance to heat, etc., is required.

Warning

May I once more appeal to all electrical engineers to cast their eyes over their friends' "temporary wiring" for their Christmas tree lights, etc? I know that it is a difficult thing to do but often well worth the possible offence caused. I was partaking of a glass of cheer in a hostelry recently and noticed that the lady behind the bar grimaced every time she had to reach past a small artificial tree gaily decorated with lights. When I asked her what the trouble was I was told that the tree seemed to scratch her arm. On looking a little closer I saw that the flexible of the decoration set was perished and bare in places and that the lady was actually placing one hand on a sink whilst she reached through, or past, the tree. A few words of explanation to the landlord and the lights were disconnected. These decoration sets of lamps are, apparently, unearthed every festive season and hung on the tree, any bare patches in the wire being covered by sticking plaster. I feel certain that better care will be taken of them now.

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Electrical equipment for graving dock

THREE YEAR REFITTING PROGRAMME COMPLETE

THE building of a new graving dock and refitting quay at Immingham, near Grimsby, a task commenced three years ago and just completed, involves considerable planning in that it lies adjacent to other docks which must be kept operational throughout the period. The opportunity was taken, at the same time, to change over the electricity supply from the British Transport Commission's 6·6 kV system to the 11 kV system of the YEB.

The new dock, to be known as the Henderson Graving Dock, is 600 ft long by 90 ft wide at the entrance and will accommodate vessels up to 26,000 tons deadweight. It is the largest dock between the Tyne and the Thames and will form a valuable addition to marine refitting facilities on the east coast.

Planning

The electrical programme was broken into three stages. The first involved the changeover of supply to No. 1 substation from 6·6 kV to 11 kV; the second covered the installation of the switchboard in No. 3 substation together with the cables and electrical services to the 1,000 ft refitting quay; the third and final stage was the installation of pumping and dockside electrical plant and cables in the Henderson graving dock.

The first stage covered the laying of duplicate 11 kV feeders from the YEB 33/11 kV dock area substation to opposite ends of the Crompton Parkinson nine-unit ALA/1.250 MVA switchboard. This board is split by a bus-coupler. One half supplies two 320 kVA hermetically sealed transformers—each of which is solidly coupled to existing slip-ring motors driving the pumps in No. 1 pumphouse—and one arm of the ring between the three substations; the other half supplies a further 320 kVA pump transformer and the old 500 kVA transformer, rewound for 11 kV.

The ring passes through No. 2 substation where a three-unit Crompton Parkinson switchboard supplies the existing 600 kVA transformer, also rewound for 11 kV, and a continuation of the ring main to No. 3 substation.

Stage 2 covered the installation of a nine-unit Crompton Parkinson 11 kV split switchboard in No. 3 substation. One half supplies a 750 kVA three-phase 11 kV/500 V transformer for low tension power, a 410 kVA three-phase 11 kV/500-385 V transformer for supplying shore current, the 385 V supply being derived from tappings on the 500 V winding and a 320 kVA 11 kV/500 V three-phase transformer through a remote operated solenoid o.c.b. for a dewatering pump. The second half supplies another 750 kVA transformer, another dewatering pump transformer and a transformer for supplying 55 kW and 220 kW Nevelin mercury-arc rectifiers. Both on this board and the main board at No. 1 substation, the bus couplers are locked out to prevent paralleling of the YEB 11 kV supplies.

This stage also included installation and connecting of the ten-unit 500 V 25 MVA switchboard, again split with bus-coupling facilities, and a three-unit 385 V 25 MVA board.

Services for the Quay

At the moment, a.c. shore current is supplied at 385 V three-phase 50 c/s, but space has been allocated for a voltage/frequency changer to be installed at a future date to provide a 440 V 60 c/s supply for ships with this system on board.

Ships berthed for repair, therefore, have the following supplies available from dockside weatherproof switchboards.

(a) 385 V three-phase 50 c/s unearthed up to 470 A.

(b) 110 V two-wire d.c., unearthed, up to 500 A.

(c) 220 V two-wire d.c. unearthed up to 1,000 A.

(d) 110 V single-phase, centre-point earthed a.c. up to 228 A.

(e) 500 V three-phase three-wire 50 c/s a.c. to supply three- and six-operator welding transformers or generators.

Similar services will also be available in the graving dock via the service tunnel.

Henderson Dock Pumphouse

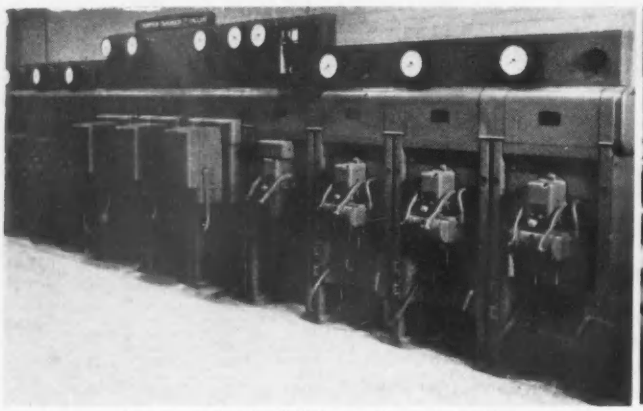
The two main dewatering pumps in the Henderson Dock pumphouse are driven by 385 h.p. 500 V three-phase squirrel cage motors solidly connected to 320 kVA 11 kV/500 V hermetically sealed transformers with power factor correction up to 0·94 provided by 100 kVAr tank-type capacitors.

Each unit is switched direct on line by remote-controlled solenoid-operated oil circuit-breakers on the No. 3 switchboard, the starting current being approximately 4½ times full load current. Auxiliary drives, which include one 115 h.p., three 80 h.p. and a number of other motors ranging between 1½ h.p. and 12½ h.p., are controlled from the operating platform on an Allen West starter switchboard. Remote switching of the main pumps is also controlled from this position.

Ring Main and other Cables

The ring main is of 0·1 sq in. cross section and terminates at the control position in No. 1 substation in oil circuit-breakers. On the boards in the other two stations, connection is through fault-making, load-breaking isolators. Under normal operation, the ring is split at No. 3 substation with each YEB feeder supplying half.

Cables are all of Crompton manufacture, this company being the main electrical suppliers. The electrical consultants were R. W. Gregory and Partners, of Newcastle upon Tyne.



Crompton Parkinson 10 unit 25 MVA switchboard in No. 3 substation

View along the dock servicing tunnel showing cables

Checking Characteristics of Electric Arc Furnaces

PRACTICAL METHOD FOR STEELWORKS INVESTIGATIONS

METHODS of determining the electrical characteristics of steel industry arc furnaces are discussed in a paper* which was presented recently to the Utilisation Section of the IEE. Works electrical staff may wish to determine these characteristics, but not all methods of doing this are equally practicable in working conditions. One of the conclusions of the paper is that a relatively simple method gives reasonably accurate agreement with results obtained from more complete tests.

Basic Characteristics

Fig. 1 shows typical electric-arc furnace characteristics. For any given voltage tap, power input to the transformer (circuit power) increases as the electrodes are lowered to increase current. It levels off at some value and finally decreases as the arc current is further increased. The useful power output, the power dissipated in the arcs, also increases at first with increase of current. The peak in the arc power characteristic represents the highest useful power which can be put into the furnace on the given transformer tap for the circuit conditions prevailing. The current corresponding to the maximum arc power is usually termed the "optimum current" for that voltage.

If it is considered that the electrical energy appearing otherwise than in the arc does no useful work, then the electrical efficiency of the installation is the ratio of arc power to total circuit power. For any given transformer secondary voltage, electrical efficiency decreases steadily with increase of furnace load, falling off rapidly after the arc power has reached its maximum. Overall circuit power factor also falls steadily with increase in load.

The most obvious way to determine the electrical characteristics of an arc furnace is to make measurements as directly as possible, changing control and protection settings to enable relatively extreme readings to be taken. For a full short-circuit test, the electrodes are immersed just inside molten metal in the furnace.

Direct measurement of arc power is difficult because of the problem of determining true arc voltage. Techniques for dealing with this problem have been developed, but they are not considered very practicable for large production furnaces.

Whatever method is used, it remains true that the complete circuit-power and arc power curves cannot be determined because of the dangers of overloading the furnace transformer in taking the necessary readings. The solution suggested in the paper is to use an equivalent circuit of the arc furnace at least to fill in the blank parts of the characteristic curves.

Equivalent Circuit

An equivalent circuit for an arc furnace is shown in Fig. 2. Each phase of a three-phase furnace can be represented for a given voltage tap, by an a.c. series circuit, including:

(1) A fixed inductive reactance, consisting of the inherent reactance of the furnace transformer, the supplementary reactor and the reactance of the furnace cable and busbars.

(2) A fixed resistance consisting of the transformer windings, cables, busbar resistance and the electrode.

(3) A variable resistance represented by the arc itself.

In the equivalent circuit shown, X_1 to X_3 and R_1 to R_3 can be determined during the short-circuit tests. It is then possible to determine points on the characteristic curves in terms of formulae which the paper develops. However, success of this method is entirely dependent on the degree of accuracy attained in measurement of the furnace constants during the short-circuit test. A complication is the change in a.c. resistance and mutual inductance which can occur when heavy currents flow during short-circuits. A change of this sort means that furnace constants derived from short-circuit tests will differ from those operating within the normal current range. It is suggested in the paper that this effect is not significant for furnaces of up to 25-ton capacity.

In making measurements on arc furnaces, it should be kept in mind that although currents are kept approximately equal in the three phases by the regulator during normal working, during short-circuit they may become quite unbalanced. In measurements on a 10 cwt experimental furnace, currents of 3,140 A, 4,560 A and 4,300 A were recorded during a typical short-circuit test with 20 V furnace voltage and 184 kW furnace power.

It can be shown that maximum circuit power occurs when the sum of the circuit resistances equals the sum of the circuit reactances.

It is clear that the determination of furnace characteristics by the method described involves considerable work. Moreover, tests may be difficult to perform on production furnaces, due to the interruption in production entailed in taking a series of observations under flat bath conditions, especially if high power inputs have to be measured. Multiple short-circuit tests required to determine phase voltages and power per phase are also detrimental to the steel-making process.

Simple Method

The paper suggests a simplified method of calculating furnace characteristics, based on treating the furnace as a balanced three-phase load. It claims that tests have established this method as being sufficiently accurate for all practical purposes.

For the simplified method to be used, it is necessary that the furnace should

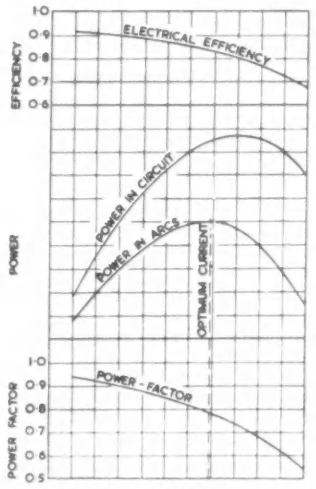


Fig. 1. Typical characteristics for electric arc furnace in steelworks

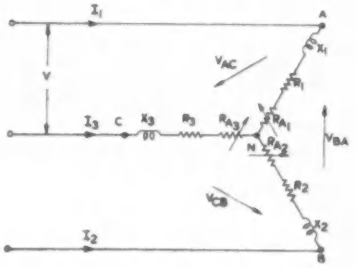


Fig. 2. Equivalent circuit for a three-phase electric arc furnace

* IEE Paper 3328: The Determination of the Electrical Characteristics of an Arc Furnace, by J. Ravenscroft, B.SC., A.M.I.E.E. Mr Ravenscroft is with Steel Peech and Tozer, and was formerly with BISRA.

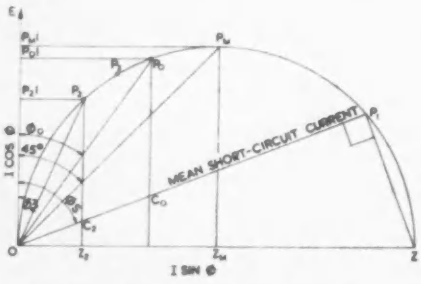


Fig. 3. Current-locus diagram based on measurement of short-circuit current

be equipped with an h.v. line voltmeter, an ammeter for each of the three phases, and a double-element indicating wattmeter or a power-factor meter. These instruments are needed for measurements as the three electrodes are dipped simultaneously into a molten-steel bath. From the readings observed, input apparent power and short-circuit power factor can be calculated. Only one short-circuit test is required for each voltage tap.

Current-locus Diagram

Observations taken during tests are used to construct a current-locus diagram such as that shown in Fig. 3. If the arc-furnace circuit is considered as a simple a.c. series circuit of constant input voltage, constant inductive reactance and variable resistance, then the locus of all possible current vectors lies on a semi-circle. This may be constructed by drawing each short-circuit current vector, e.g., OP_1 at angle φ_s to the vertical, where φ_s is the phase angle at short-circuit. P_1Z drawn at right angles enables the diameter of the circle to be found, since there is a right angle between the vertical voltage vector and OZ. All operating points P_2, P_3, etc., then lie on the semi-circle, and other values such as circuit power, arc power, electrical efficiency can be obtained from the diagram by application of suitable formulae and geometric constructions.

When characteristic curves were plotted for the experimental furnace previously mentioned, on a basis of the current-locus diagram described, it was found that for both circuit power and arc power characteristics there was little difference between the results obtained by the two methods. For example, on the 130 V tap, the circuit power for an electrode current of 2,500 A was determined from the locus diagram as 554 kW, which compared closely with the value of 558 kW calculated on the basis of more complete tests. Optimum currents determined by the two methods will also be found to be similar. 3,685 A given by the locus comparing with 3,750 A on a basis of measurement.

Conclusions

In comparison of the methods available for determining furnace performance it is suggested that the direct method has limited application for production furnaces. If a series of short-circuit tests can be made to determine furnace constants without interfering too much with production, the complete characteristic can be derived by calculation using simple formulae. The success of this method, however, is entirely dependent on the accuracy of the measurements during the short-circuit tests. Performance curves can be drawn reasonably accurately by using a current locus diagram plotted from data obtained from a single short-circuit test. Provided working current is well below the optimum level, this simple technique gives close agreement with results obtained by the two other methods.

The paper reports experimental work on a 10 cwt furnace which confirms these conclusions. The comment is made that if circuit reactance is high the load current can approach or exceed the optimum value, and it is important that the optimum currents should be forecast accurately so that the load does not exceed these values during normal operation of the furnace, and so waste power. Characteristic curves for the 10 cwt furnace in fact show that it is most efficient when operated on the highest voltage tap.

Sealed transformers in extreme conditions

IF the tank of a transformer is hermetically sealed, the conservator or similar equipment to take care of breathing may be omitted. Some while ago, the Shell International Oil Co. bought 15 transformers of this type from C. A. Parsons, and installed them in Sumatra in the Far East. One of these transformers was returned to the works after nine years' service for examination to establish the performance of this type of design in extreme conditions.

Like others in the batch, the transformer was installed in an open unprotected situation, in the tropical sun. It was subjected to fluctuating loads (domestic supply) with high peak loading during the daytime.

The transformer was a 100 kVA three-phase 50 c/s unit for ON cooling in a plain tank. It was arranged for 6,300-3,150 V primary (series-parallel) and 220 V secondary. Tappings were provided for ±2½% and ±5% on the h.v. winding. Cable boxes were provided for both h.v. and l.v. windings. The oil used was Shell Diala B.

Preliminary Tests

Testing at the C. A. Parsons works took the form of preliminary tests before the transformer was opened, followed by piercing the sealed case and the carrying out of further tests on the transformer and on oil samples.

The initial tests showed satisfactory insulation resistance between h.v. and l.v. windings and earth, and a satisfactory dispersion (a measure of the insulation power factor) when cold. When the transformer was hot, and a positive pressure presumably existed in the gas space above oil level, the transformer was thoroughly examined for indications of leakage at all joints, particularly the cable box bushings. No signs of leakage were found.

Breaking the vacuum seal was carried out by drilling the cover through a special drilling device that would permit holding the vacuum presumed to exist at normal ambient temperature. In fact, a vacuum of 4·4 in. mercury (12½ lb/sq in. absolute) was found to exist at a temperature of 67°F. The cold oil level was found to be correct to within about ⅛ in. of the mark to which the transformer had been filled before sealing.

Oil samples were found to be generally satisfactory. An independent test showed the samples to be slightly acid, but the opinion was expressed that a large part of the acidity was due to the presence of dissolved varnish acids in the oil. The inside of the tank was painted with copal varnish.

Internal Condition

When the cover weld of the tank was chipped off (the operation took about an hour) inspection of the cover showed the condition of the internal painting "as good as new." Close inspection of the oil surface showed small traces of surface contamination adjacent to the tank walls. These were presumed to be from the varnish coating of the tank.

To remove the core and windings it was necessary to lower the oil level to permit access to bushing connections. When through-tank bushings were removed, Neo-K-Tex gaskets were found to be in sound, pliable condition.

Core and windings, when lifted from the tank were in a clean condition with no deposits on any of the horizontal surfaces. Windings were "fairly dark" in colour, but otherwise in new condition. End packing on windings was tight, and there was no sign of deterioration of off-circuit tapping and series-parallel switches. Inspection of the tank after pumping out the oil showed all internal surfaces to be clean.

Overall, the verdict on the transformer was "excellent condition."

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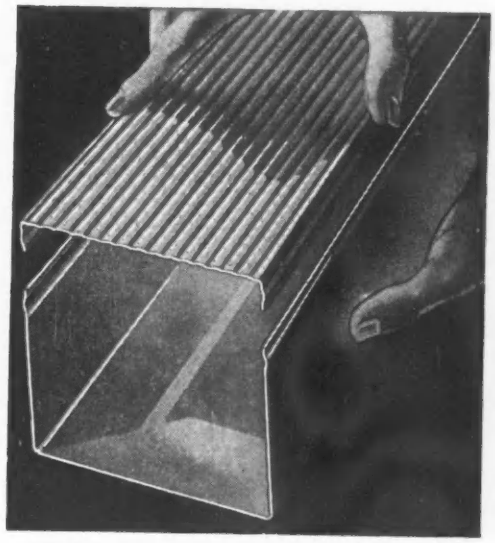

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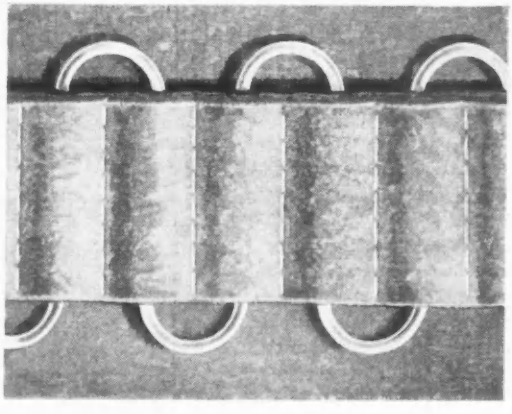

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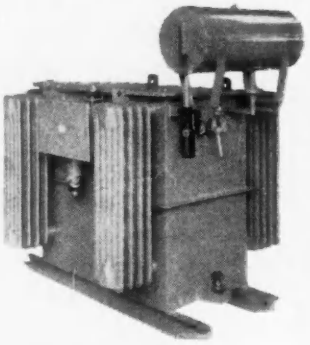

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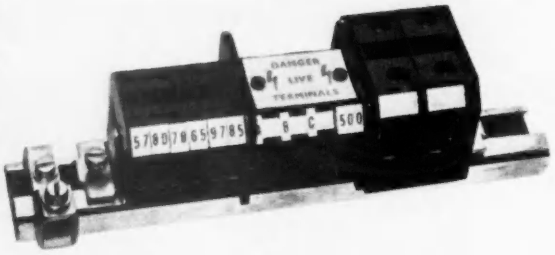

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A.E.I. A.S.D. Air-Break Starter

DATA SHEET 39

THE apparatus illustrated is a simple, manually operated star-delta starter designed for the infrequent switching of three-phase six terminal squirrel cage motors. Its general design is very similar in many respects to that adopted by other makers. Indeed, it is quite apparent that control gear tends, by necessity, to follow established practice which is modified to suit the particular ideas of each manufacturer.

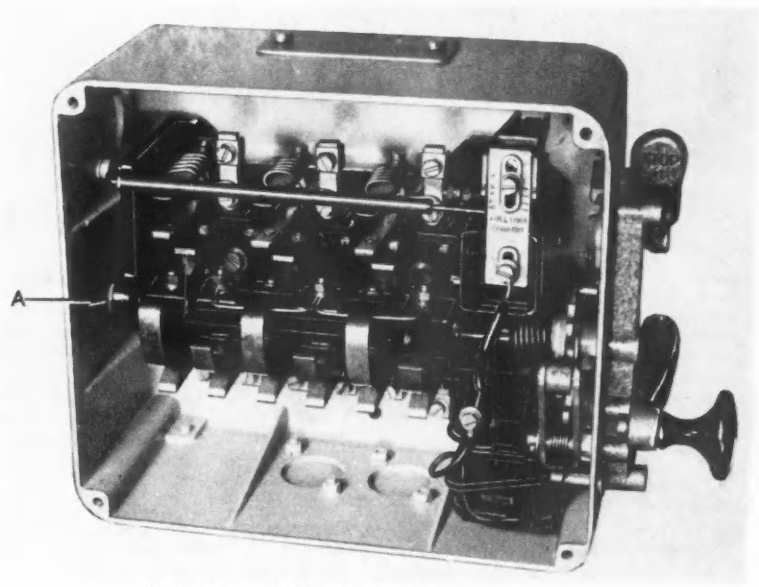


Fig. 1. Interior of AEI air-break star-delta starter

General Construction

The case and lid of this starter are die-cast. The cover, which is not shown in Fig. 1, is not hinged, and is retained by four screws.

Three conduit entries, covered with gland plates, are provided: one at the top left side of the case and two at the bottom, while a blanked hole on the top of the starter permits the fixing of an ammeter should it be required.

This dust- and damp-proof enclosure houses a typical drum-type starter, operated by a lever on the right-hand side. Depressing this lever connects the motor in star for starting, elevating the lever changes the connection to delta for running. The usual gravity device is incorporated to prevent the handle being inadvertently placed in the running position without first pausing in the starting position.

Once the motor is running correctly the catch on the u.v. relay retains the starter hand in the vertical position. A small lever on the top right of the case will trip the starter.

The inside of the cover carries a connecting diagram, die-cast in the metal itself.

Drum Switch

The main body of the drum switch is a bakelite moulding, fixed by two cheese-headed screws to the back of the case. This moulding carries the two sets of fixed contacts and the three overload relays. The drum switch is also a moulding and does not consist, as in many other starters, of a number of contacts and insulated spacers threaded on to a steel bar. In the present starter the moulding itself forms a strong insulated bar to which the moving contacts are bolted. One end of this moulding engages a dog drive operated by the starting handle and the other end is supported by a pivot screw (A) which passes through the side frame of the main moulding. (See Fig. 1.)

A portion of the drum switch is drawn in Fig. 2 which also shows the cavity for the dog drive (1). The moving contacts are formed from copper strip. One of the fixed contacts is included in Fig. 3.

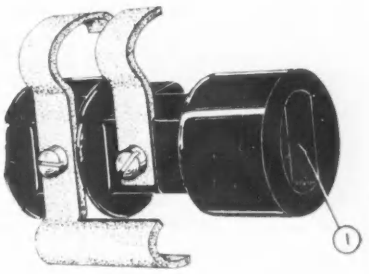


Fig 2. Part of drum switch seen at bottom of Fig. 1

Under-voltage Relay

In starters of this type the u.v. relay performs two functions; it retains the handle of the starter in the running position once the motor has been started, and it will release this handle and so switch off the starter when the volts fail, or drop below a predetermined level.

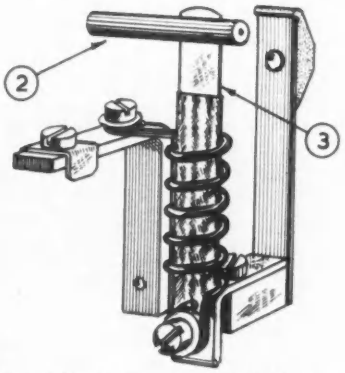


Fig. 3. Fixed contact associated with drum switch, and o.l. heater. In the starter this is at right angles to position shown (Fig. 1)

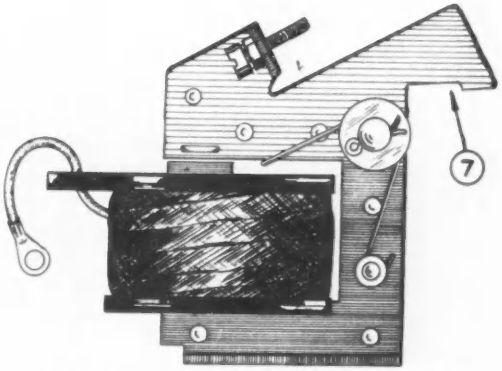


Fig. 4. Under-voltage relay, bottom right of Fig. 1

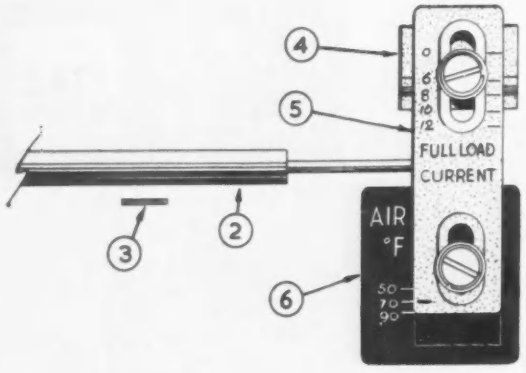


Fig. 5. Contacts associated with under-voltage relay

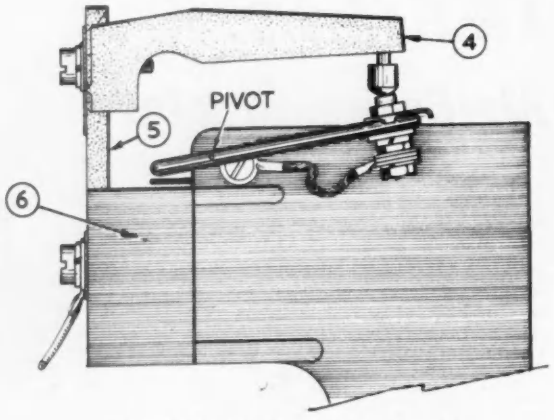


Fig. 6. Bracket (4) of Fig. 5 in front elevation

Fig. 4 shows that this u.v. relay is of the normal clapper type with the armature extended to form a hook (7) which engages the handle linkage. The coil itself is wound on a moulded former and is retained on the stampings by a U-shaped wire spring. Each coil carries a copper strip bearing a code number but not the coil voltage. A wide range of coils is available for this starter, covering voltages from 47-675 and frequencies 50 or 60 cycles.

Overload Relays

In the example illustrated, the overload relays use a thermal bimetal strip. The three units can be seen in the photograph at the top of the main switch moulding and one item is shown in detail Figs. 3, 5. It is a very simple device with a heater spiral surrounding a bimetal strip (3) which is free to move. Excessive current will cause the bimetal strip to bend and move the trip bar (2). This trip bar actuates a pair of contacts in series with the u.v. relay and these are shown in detail in Fig. 6. The trip bar is pivoted as indicated and carries one contact at its extreme end. The other contact, which is spring loaded, is attached to a die-cast bracket (4) whence current is carried, via a second die-casting (5) to the auxiliary circuit.

Fig. 5 also shows bracket (4) in front elevation where the method of attachment is illustrated. The position of the bracket can be varied to give different current settings. Compensation for ambient temperature is effected by another adjustment where the whole die-cast assembly (4) and (5) can be moved according to the calibrations on the bakelite body (6) which carries the trip contact assembly.

Other models of this starter are fitted with magnetic overload trips.

Maintenance

There is little to go wrong with a starter of this kind. Dismantling is simple and the removal of the pivot screws (A) (Fig. 1) enables the switch drum to be removed.

The rest of the starter is equally accessible.

It is, however, worth while to quote from the instruction handbook: "The working face of the contacts inevitably become roughened and pitted in service but this is not detrimental to their efficiency. Any large blobs of copper that may have formed should be removed, but it cannot be too strongly emphasised that it is not necessary to file the contacts to a smooth finish."

FIRE RISKS WITH ELECTRICAL MATERIALS

IT is not always realised that p.v.c. carries risks of damaging metals if it should be involved in a fire. The October number of *FPA Journal*, published by the Fire Protection Association, reports a fire in Denmark in which this was unfortunately well demonstrated. The fire involved a storage department of a factory making electronic instruments and television equipment. It started in an office, and only part of the storage area was directly damaged by fire. However, on the shelves were some components made from p.v.c. weighing in all about 55 lb.

Corrosion

When involved in a fire this amount of p.v.c. will produce about 350 cu ft of gaseous hydrogen chloride, and this will dissolve in water to form hydrochloric acid, which is extremely corrosive to most metals. As a result of the fire, the hydrochloric acid corroded all the ferrous metal parts of the equipment in the store except those which had been coated with a thick layer of nickel. Components covered with thin layers of cadmium or zinc were severely damaged and brass and copper parts were also damaged. Even lacquered surfaces were attacked to the extent of their corrosion resistance being affected.

The damage to the structure of the building amounted to £5,000 but the damage to the contents, which was almost entirely by corrosion and not by fire, amounted to £150,000.

Sprays for Rubber

Other materials widely used in electrical engineering also introduce fire risks, although not so unexpectedly. Rubber is an obvious risk, and the same number of the *FPA Journal* recommends that a sprinkler system giving a water spray should be installed in the dough-mixing section where rubber compounds are being prepared. The system should preferably be such that in the event of a fire in one hopper, a water screen can be discharged round it. For extinguishing fires in hoppers, carbon dioxide systems, fixed and preferably manually operated, are suitable.

Machining Aluminium

Freshly machined aluminium introduces a risk since it oxidises in contact with moist air. In the case of swarf, however, the heat generated is insufficient to cause ignition. Aluminium dust particles, because of the greater surface area they present, are a different story.

Chromium plating is judged to present little fire hazard, despite the evolution of hydrogen from the acid solution. The recommended precaution for dealing with this is provision of high-level extraction plant as part of the ventilation system.

Commerce House, Birmingham

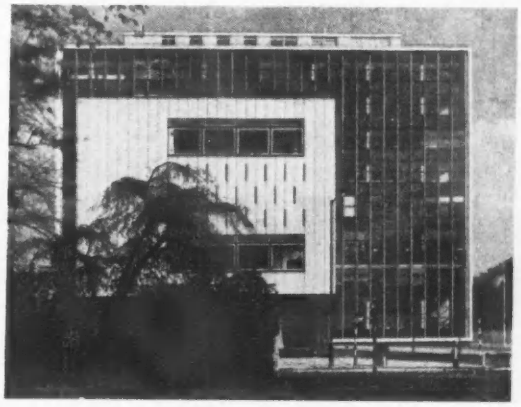
ELECTRICAL EQUIPMENT IN IMPOSING NEW BUILDING

WHEN a group of people got together in Birmingham in 1783 to form the Birmingham Commercial Committee, they little knew that they were laying the foundation of a movement which, 177 years later, was to have associates in every important town and city throughout the country, the Chambers of Commerce. Actually, the name dates from the reformation of the body in 1813 after the original committee had fallen out among themselves, but the new Chamber never again looked back. Such was the impact of the organisation that it soon had other towns copying until, in 1860, the Association of Chambers of Commerce was formed. This year, marking the centenary of that act, Birmingham again shows its leadership by moving into the new premises, to the design of John H. D. Madin, A.R.I.B.A., which they have erected, at a cost of £500,000, in Harborne Road, Edgbaston. The building, T-shaped in plan, comprises a stem, four storeys high, in which the main Chamber suites are installed, and an eight-storey commercial block as the crossbar, which is let out to business houses and others requiring office accommodation. Among the latter is the United States Consulate and the British West Africa Corporation.

Chamber and Offices

The Chamber offices include a Presidential Suite, the Council Chamber, meeting rooms, library and information offices and administrative sections. There is also a Chamber of Commerce club and on the roof a penthouse lunch bar. Below and around the building there is ample car-parking space.

The council chamber is a handsome room 75 ft long by 25 ft wide with acoustics so excellent that microphones are unnecessary. By night, light is from 12 semi-recessed GEC lighting units with six 4 ft Osram Warm White tubes on switchless-start circuits. The President's room is lit by standard 6 ft by 2 ft recessed module fittings, while other executive offices are illuminated by 6 ft by 2 ft recessed module fittings.



Electrical Services

Supply is taken from the MEB at 400/230 V from a substation in the basement which also serves part of the surrounding district. Two 500 A ironclad GEC switches serve rising mains to the Chamber and business blocks from which distribution to each floor is via skirting board trunking with cross-trunking in the ceiling for lighting. Each of the floors in the business block is arranged for separate metering to tenants with a maximum of four tenants per floor. Telephone circuits are segregated in separate trunking.

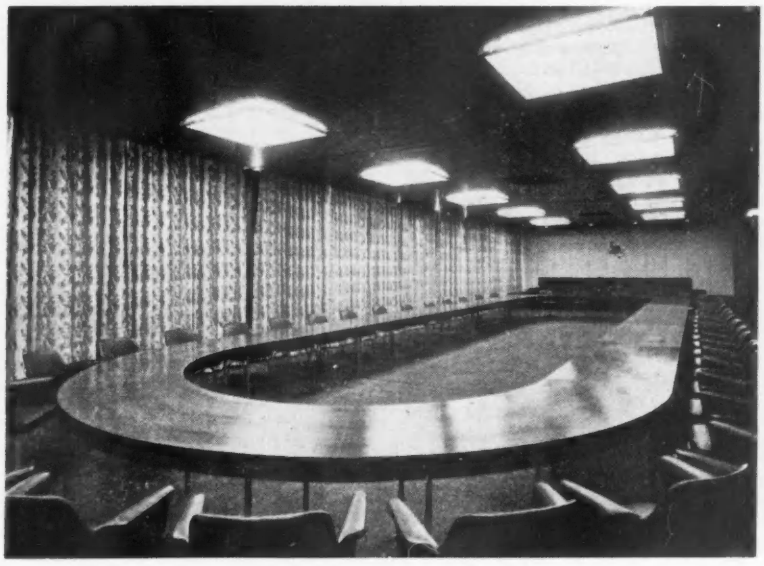
The main cables are v.r.i.-insulated with a proportion of m.i.c.c. in subsidiary circuits. All lighting switches are of the "Britmac" silent pattern.

Lighting throughout has been planned to give a higher-than-average level of 30-35 lumens/sq ft, most of which is by switchless-start fluorescent fittings; 60 W tungsten filament lighting is used in the entrance halls.

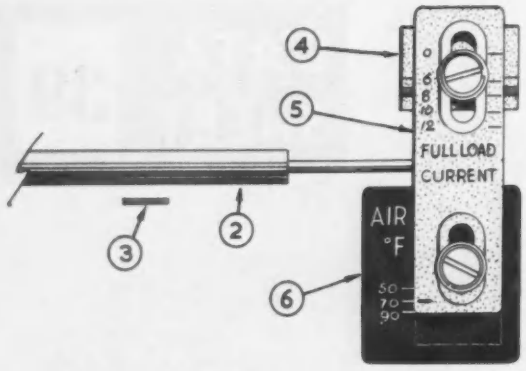
In the eight-storey building there are three 300 ft/min passenger lifts and, in the commerce block, two 200 ft/min passenger lifts. There are also a goods lift and a service lift. All lifts are by the Express Lift Co. and incorporate the latest system of Express traffic control. The internal telephone system comprises two master stations and 11 substations with transistorised amplified loud-speakers and sensitive microphones to allow of hand-free conversation on the masters.

Other interesting electrical features include a 500-station automatic fire detector system and under-ramp electric heating to prevent the formation of ice on the approach ramps outside the entrance.

The main electrical contractors were Parker Winder and Achurch, and the GEC supplied most of the electrical equipment.



A view of the handsome 75 ft long council chamber in Birmingham's new Chamber of Commerce building. By day the curtained area is an unbroken window space. By night illumination is from the GEC semi-recessed fluorescent lighting fittings



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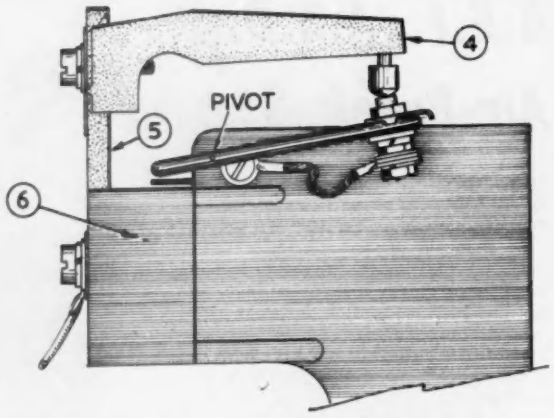

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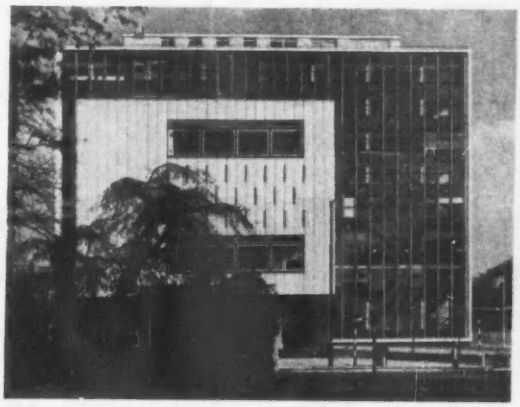
Chamber and Offices

The Chamber offices include a Presidential Suite, the Council Chamber, meeting rooms, library and information offices and administrative sections. There is also a Chamber of Commerce club and on the roof a penthouse lunch bar. Below and around the building there is ample car-parking space.

The council chamber is a handsome room 75 ft long by 25 ft wide with acoustics so excellent that microphones are unnecessary. By night, light is from 12 semi-recessed GEC



lighting units with six 4 ft Osram Warm White tubes on switchless-start circuits. The President's room is lit by standard 6 ft by 2 ft recessed module fittings, while other executive offices are illuminated by 6 ft by 2 ft recessed module fittings.

Electrical Services

Supply is taken from the MEB at 400/230 V from a substation in the basement which also serves part of the surrounding district. Two 500 A ironclad GEC switches serve rising mains to the Chamber and business blocks from which distribution to each floor is via skirting board trunking with cross-trunking in the ceiling for lighting. Each of the floors in the business block is arranged for separate metering to tenants with a maximum of four tenants per floor. Telephone circuits are segregated in separate trunking.

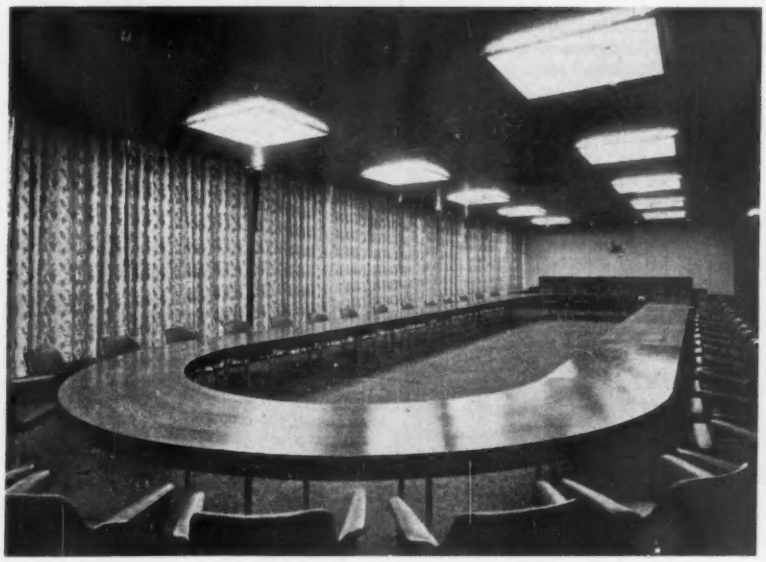
The main cables are v.r.i.-insulated with a proportion of m.i.c.c. in subsidiary circuits. All lighting switches are of the "Britmac" silent pattern.

Lighting throughout has been planned to give a higher-than-average level of 30-35 lumens/sq ft, most of which is by switchless-start fluorescent fittings; 60 W tungsten filament lighting is used in the entrance halls.

In the eight-storey building there are three 300 ft/min passenger lifts and, in the commerce block, two 200 ft/min passenger lifts. There are also a goods lift and a service lift. All lifts are by the Express Lift Co. and incorporate the latest system of Express traffic control. The internal telephone system comprises two master stations and 11 substations with transistorised amplified loud-speakers and sensitive microphones to allow of hand-free conversation on the masters.

Other interesting electrical features include a 500-station automatic fire detector system and under-ramp electric heating to prevent the formation of ice on the approach ramps outside the entrance.

The main electrical contractors were Parker Winder and Achurch, and the GEC supplied most of the electrical equipment.



A view of the handsome 75 ft long council chamber in Birmingham's new Chamber of Commerce building. By day the curtained area is an unbroken window space. By night illumination is from the GEC semi-recessed fluorescent lighting fittings

Personalities *in the industry*

Mr H. J. Unwin

Mr A. M. Hudson Davies

Mr A. P. Harvey

Mr D. A. Laverack

Mr E. J. Haslock

Mr H. J. Unwin, A.M.I.E.E., has been appointed assistant chief commercial officer (sales development) to the Eastern Electricity Board, with responsibility for the promotion of sales of load development appliances and improvement of retailing techniques in the Board's showrooms (*ESH, pages 105, 107). Mr Unwin started his training in 1932 as an engineering apprentice with the BTH Co., Rugby, and later worked with them as a research engineer until the outbreak of the war, when he took a commission in the electrical branch of the RNVR. He entered the supply industry after the war and has held commercial posts with the Cambridge Electric Supply Co. and with the Eastern Electricity Board in the Fens sub-area and at their headquarters. In 1957 he was appointed manager of the Board's Thurrock district, which he leaves to take up his new appointment on 2 Jan. next. Early this year Mr Unwin attended a three-month management course at the Administrative Staff College, Henley. He was chairman of the Board's working party created last year to investigate and make recommendations upon procedures for acquiring substation sites and wayleaves.

Mr A. M. Hudson Davies, O.B.E., M.A., F.I.W.M., has been elected chairman of the Institution of Works Managers for 1960-61, with **Mr J. Ayres,** M.I.E.E., M.I.P.E., managing director, Simms Motor Units Ltd., as deputy chairman and **Mr H. E. Drew,** M.BRIT.I.R.E., M.I.P.E., director of electronic production, Ministry of Aviation, again as honorary treasurer. Mr Hudson Davies became managing director of Fibreglass Ltd. in 1946, and joined the board of Pilkington Group Ltd., the parent company, in 1952.

Two power station superintendents with the London Division of the CEGB are to retire at the end of March next. They are **Mr A. W. Dunbar,** at Lombard Rd, and **Mr D. Halliday,** A.M.I.E.E., at Woolwich (*ESH, page 57). Mr Dunbar will have completed 50 years' service in the industry. He has been station superintendent at Lombard Rd since 1930, and was previously at Blackwall Point, at Bow and, earlier, with Metropolitan-Vickers. Mr Halliday has been station superintendent at Woolwich for the past ten years and has served there since 1923.

Chief engineer of the Switchgear Division of the Brush Electrical Engineering Co. Ltd. since 1955, **Mr A. P. Harvey,** A.M.I.E.E., has transferred to Bristol Siddeley Engines Ltd. as senior electrical engineer. He originally joined the Brush Co. in 1953, after eight years in the electricity supply industry, first with the CEB, South East England Region, as a technical engineer and, after vesting day, with the Eastern Division of the CEA as a regional technical engineer. Mr Harvey served his apprenticeship with A. Reyrolle and Co. Ltd. and joined their Technical and Research Department in 1934.

Mr G. J. Rackham, a director of Simms Motor and Electronics Corporation since 1950, has resigned for health reasons.

Mr John C. Garrels, jnr., has been appointed deputy managing director of Monsanto Chemicals Ltd.

The Electric Construction Co. announce that, for health reasons, **Mr Dennis A. Laverack,** M.A.M.E.M.E., is to relinquish duties as area manager for Yorkshire as from 1 Jan. next, but he will continue to act in a consultant capacity within the area. His successor as area manager will be **Mr E. J. Haslock,** A.M.I.E.E., M.A.M.E.M.E., who has been Mr Laverack's assistant since July, 1958. Mr Laverack was educated at St. Peter's School, York, and subsequently became an articled apprentice with the company in 1916, receiving training in all departments of the Wolverhampton works. During this period he became chief student of the Wolverhampton and Staffordshire College. Following Test Department service he was attached to the Works Estimating Department from 1923-27, preparing tenders and contracts for all types of rotating machines and switchgear. In 1927 he was appointed outside sales engineer in the counties of Derbys and Notts, with headquarters at Derby, and afterwards he was transferred to take charge of the Yorkshire area. When the company opened area offices at Leeds, in 1958, Mr Laverack became area manager. Mr Haslock trained with Siemens Brothers and Lancashire Dynamo and Crypto, and gained other technical training at Hackney Technical College. From 1941 to 1950 he was contracts manager for Bryce Electric Construction Co., later becoming area manager in East Midlands and Yorkshire for Bryce Electric and Hackbridge Cable Co. Ltd. He joined ECC in 1958.

Mr W. C. Balle, W. T. Henley's area board representative maintaining contact with the Midlands Electricity Board, was presented at Birmingham with a convector heater and an electric kettle by **Mr W. I. Willey,** cable regional sales manager, Birmingham, on behalf of friends and colleagues in the area. At the Hatton Garden office in London he received a letter of appreciation from the company, together with a cheque subscribed by his colleagues—presented by **Mr F. V. Vaissiere,** commercial manager, AEI Cable Division, to mark his retirement.

District engineer in the Taunton district, Electrical Department, South Western Division of the CEGB, **Mr L. F. M. Baker,** B.SC.(ENG.), M.I.E.E., has retired. His successor is **Mr C. L. Chalk,** B.SC.(ENG.), A.M.I.E.E., formerly assistant district engineer at Taunton. Mr Baker started in the electricity supply industry in 1923 as a district engineer with the South Wales Electrical Power and Distribution Co. In 1932 he joined the CEB as a transmission section engineer at Bridgwater and continued in that position until 1959 when he was promoted to district engineer on the formation of the Electrical Department. He has served on many committees and was chairman of

** Denotes revision to the "Electricity Supply Handbook, 1960."*

the Supply Group of the IEE Western Centre in 1956. His retirement was marked by the presentation of an electric blanket, toaster and picnic basket at a function at the SWEB social club, and of a refrigerator by the Divisional Controller, Mr H. S. Davidson, on behalf of colleagues and friends, at a dinner at the Grand Hotel, Bristol, which Mr A. C. Thirtle, Regional Director, also attended.

Major changes in the board of Morphy-Richards Ltd., following the acquisition of the business by EMI, are now announced. **Mr F. P. Bishop,** the chairman, has resigned from the board at his own request and has been replaced as chairman by **Sir Joseph Lockwood,** chairman of EMI. **Mr D. L. T. Oppe** also has resigned and **Mr J. E. Wall,** managing director of EMI, has become a director. **Mr C. F. Richards,** who has been a joint managing director since the formation of the company in 1936, has given up that post and left the board in order to pursue other interests but "the benefit of his experience and advice has been secured to the company in a consulting capacity." **Mr D. W. Morphy** has relinquished the post of joint managing director, at his own request, but will remain a director of the company. **Mr W. Roxburgh**—managing director of Morphy-Richards (Astral) for many years and a director of the parent company since 1959—has been appointed sole managing director. **Mr H. W. A. Griffiths,** director and general manager of Morphy-Richards (Cray) and **Mr Z. Weyde,** director and general manager of Morphy-Richards (Astral), have been appointed to the Morphy-Richards board. It will be recalled that the original offer of EMI for the M-R capital was strongly opposed by three of the five directors, Mr Bishop, Mr Richards and Mr Oppe, and was supported by Mr Morphy and Mr Roxburgh. Mr Griffiths only joined Morphy-Richards last April as general manager—some three months before the takeover bid—and was previously manager of the Instruments Division of Evershed and Vignoles Ltd.

Manager of the Woking district of the South Eastern Electricity Board since 1955, **Mr E. Peel,** M.I.E.E., has been appointed manager of the Board's Sutton district to succeed **Mr W. B. Hayden,** M.I.E.E., who is retiring on 7 April, 1961 (*ESH, page 85). Mr Peel, who is 44, is a Lancastrian and received his technical education at Blackburn Technical College and Regent Street, London, Polytechnic, starting his career as a trainee with the electricity department of Blackburn Corporation. After war service as an officer in the RAF electrical engineering branch he was appointed as a mains assistant with Hammersmith Corporation, and later became a first assistant district engineer with the London Electricity Board. He joined Seeboard in 1954 as district engineer at Woking.

Mr W. Roxburgh

Mr T. L. Watman

Mr J. M. Storey

Mr T. Lisle Watman, A.M.C.T., A.M.I.E.E., has been appointed director and general manager of the Indian National Diesel Engine Co. (INDEC), Calcutta, an associate company of Hawker Siddeley Industries, to set up facilities for the manufacture of Petter diesel engines under licence in India. He will be leaving his present post as executive assistant to the joint managing directors of Hawker Siddeley Industries in January, 1961. Before joining HSI in 1959, Mr Watman had served as technical adviser to the Carborundum Co. Ltd. and as assistant chief engineer with Colgate-Palmolive Ltd. He later headed a reactor design team for the English Electric Co. and served as a technical co-ordination engineer for their consortium in London.

Assistant sales manager (power cables) to BICC since last March, **Mr M. H. Beattie,** E.R.D., M.I.E.E., has been appointed commercial manager, British Insulated Callender's (Submarine Cables) Ltd. Educated at Glasgow and Kelvinside Academies and the Royal College of Science and Technology, Glasgow, Mr Beattie joined Scottish Cables Ltd. after war service. From 1948 until March this year he was their London sales manager. In his new post Mr Beattie will be located at 21 Bloomsbury St, W.C.1.

Mr James M. Storey, C.B.E., managing director of Dewrance and Co., a subsidiary of Babcock and Wilcox, will retire at the end of December. Mr Storey was leader of the Economic and Goodwill mission to the Canadian Petroleum and Allied Industries in May, 1957. He was awarded the C.B.E. in January, 1959.

As we briefly reported last week, on the retirement of **Mr J. J. Gracie,** C.B.E., LL.D., M.I.E.E., at the end of this month (as we intimated on 7 July last) **Mr T. H. Kelsey,** M.A., M.I.E.E., will become general manager of the General Electric Co.'s engineering works at Witton and **Mr W. D. Morton,** M.A., A.M.I.E.E., A.M.I.MECH.E., is to be assistant general manager as from 1 Jan., 1961. Mr Kelsey, who was born at Gainsborough in 1905 and educated at Uppingham and Downing College, Cambridge, joined the GEC at Witton in 1929. In 1932 he moved to the company's Manchester office and, in 1935, became assistant branch engineer at the Liverpool office. In 1940 he returned to Witton, where he was responsible for the section of the Materials Control Department concerned with high priority contracts, until 1942. He then joined the Ministry of Supply and, in 1944, became deputy director in charge of the Directorate of Industrial Electrical Equipment (DIEE Machine Tool Control). When the Machine Tool Control was closed down in 1946, Mr Kelsey became director of disposals but, in 1947, he returned to the GEC as their representative at BEAMA and became a mem-

Mr E. Peel

Mr M. H. Beattie

Mr J. J. Gracie

Mr T. H. Kelsey

Mr W. D. Morton

ber of the BEAMA Contract Conditions and Materials Committees. In 1955 he was appointed technical assistant to Sir Harry Railing and, on Sir Harry Railing's retirement, personal assistant to Mr A. L. G. Lindley. In 1958 he became assistant general manager at Witton and, in June, 1960, deputy general manager. Mr Morton, who was born at Killamarsh, near Sheffield, in 1924, was educated at Doncaster Grammar School and St. John's College, Cambridge, where he graduated in mechanical science in 1944. On leaving the University he joined the Armaments Design Department of the Ministry of Supply and was engaged on the design of solid-fuel rockets. Eighteen months later he joined the English Electric Co. as a graduate apprentice, spending six months with the Atlas Diesel Co., in Sweden, on an apprentice exchange scheme. He was appointed a traction engineer in 1948. Mr Morton joined the GEC in 1958 as manager of the Traction Division. Mr Gracie, who has been general manager of the Witton Works for the past 20 years, has also played a prominent part in Birmingham's educational affairs, particularly on the technical side, and also holds a number of appointments on various bodies concerned with industry and commerce generally. With GEC he started at the Osram Lamp Works and later transferred to the MO Valve Co., where he introduced quantity production methods. From 1931 to 1937 he was with a firm of industrial consultants, but returned to GEC to become general manager and a director of Coldair Ltd. A year later he was appointed commercial manager of Witton Engineering Works and, in 1940, became general manager.

Mr W. Fraser, chairman and managing director of Scottish Cables Ltd., will go to Nigeria next month as a delegate to an industrial development conference. The 17-strong British delegation will tour Nigeria before attending the conference in Lagos.

Belling and Lee Ltd. announce the appointment of **Mr B. M. Lee** as manager of their industrial group, reporting to the company's general manager, and to the board of executive directors. This is a further step in the divisionalisation of the company into separate industrial and domestic groups, in a programme of controlled expansion which began with the reorganisation of the sales department earlier in the year. He will be responsible for co-ordinating the production, publicity and sales of the industrial group. Mr Lee, who is the son of **Mr E. M. Lee,** B.SC., M.I.E.E., director and general manager, and one of the original founders, has spent a number of years in different departments of the company and in other companies in the industry.

Sir Harold Bishop, C.B.E., M.I.E.E., director of engineering, BBC, has been elected president of the Television Society in succession to the late **Sir George Barnes,** M.A., D.C.L., Sir Harold will hold the office for a two-year period.

General sales manager of the company, **Mr William A. Devon** has been appointed to the board of Venner Ltd. from 1 Jan., 1961.

Mr J. Maxwell has been appointed factory manager of the Remington electric shaver factory at Thornliebank industrial estate, Glasgow.

Mr D. Wright has been appointed chairman of H. J. Baldwin and Co., in place of **Mr H. J. D. L. Walmsley** who has resigned the position. Mr Wright is joint managing director of the parent concern, Hartley Baird Ltd.

For health reasons, **Mr J. H. Russell** is relinquishing his position as managing director of Hall and Pickles Ltd. on 1 Jan., 1961, but he will retain his seat on the board and also on the boards of Hall Engineering (Holdings) Ltd. and the Improved Metal Label Co. Ltd. **Mr F. R. Robbins** and **Mr A. M. C. Murphy** are to become joint managing directors, and **Mr E. W. B. Davis** will be general sales director.

Mr T. D. Gregory is appointed manager of the English Electric Co.'s Calcutta office. He has been export area manager for North America in the company's London offices for the last year, following five years as deputy manager, Contracts and Administration, in New York. **Mr B. P. Rivett,** who has been the company's west coast technical representative in the United States for the last five years, succeeds Mr Gregory as export area manager, North America, in London. Mr Gregory joined the company as a student apprentice in 1935. He was appointed a sales engineer on heavy plant at Stafford and with the London office. In 1945 he took over as manager in the Eastern Electricity Board area at Ipswich, where he remained until he joined the English Electric Export and Trading Co. Ltd. in New York. He served as deputy manager, Contracts and Administration, in the US operation until 1959. Mr Rivett joined the EE Co. as sales engineer for electrical plant at the Stafford works in 1951, where he remained for three years. From 1955-60, Mr Rivett was the company's technical representative for the west coast territory of the United States. In this capacity he was closely concerned with many of the important contracts for heavy plant awarded to the company.

Col C. E. Mackellar, director of Westool Ltd., and **Mr J. B. Bailey,** chief applications engineer of the company, are now on a visit to Russia to discuss modern techniques in coil winding and the application of various control equipment to Russian industry. They will also explore the possibilities for the export to Russia of coil-winding machines, electric clutches and brakes and air-conditioning equipment.

We hear from the London Electricity Board that **Mr W. A. F. Howard,** M.I.E.E., A.M.B.I.M., has been transferred from the position of district engineer of the Central District to a similar post with the Northern District (*ESH, page 78). This follows the appointment of **Mr J. P. Tanner,** A.M.I.E.E., as manager of the Board's North Western District. Mr Howard was sub-area construction engineer for the Board's northern sub-area from vesting day until May, 1957, when with the reorganisation of the Board's area he became district engineer, Central District.

Two sales representatives of Edmundsons Electrical Wholesalers Ltd. have just completed 50 years' service. They are: **Mr C. F. Hutley** and **Mr S. H. Snell.** Mr Hutley is well known to the electrical fraternity in the City and West End, while Mr Snell, who retires on 31 Dec., has concentrated on the East London postal area in recent years. Presentations are to be made to them both next week.

Mr E. H. N. Breeze has been appointed commercial manager of Lucas Industrial Equipment, a member of the Lucas group of companies.

Previously personnel manager with Rolls-Royce Ltd., **Mr D. H. Atkinson** has been appointed to a similar post for the Ilford region of the Plessey Co. Ltd.

Appointed to the position of director of the International Atomic Energy Agency's Division of Scientific and Technical Information is **Dr Bernhard Goss** who has served with the IAEA since November, 1958, and from 1949 to 1950 was with the Electrical Research Association on a British Council fellowship.

Mr A. A. Young has joined B and R Relays Ltd. as sales engineer for Scotland and Northern Ireland. He was previously an electrical engineer at the BP Refinery at Grangemouth.

Sir Willis Jackson, D.SC., F.R.S., has accepted the invitation to become president of the Association of Supervising Electrical Engineers, and will succeed Sir Josiah Eccles, C.B.E., on 1 Jan. next. It will be recalled that Lord Verulam was to have become president but died on 18 Oct.—the day before Sir Josiah retired from office, and the latter subsequently agreed to continue as acting president until a successor was appointed. Sir Willis Jackson, who will be installed as

At the opening of Atlas Lighting's Glasgow showroom (referred to on page 940), left to right: Mr G. Gibson, Mr A. S. Shier, Dr H. H. Ballin, Mr J. W. Moule (chief commercial officer, S. Scotland EB), and Mr G. S. Bowman (North of Scotland HE Board)

president at the meeting of the IEE on 17 Jan., is director of research and education to Associated Electrical Industries (Manchester) Ltd., a position which he is to relinquish next Oct. to return to the Imperial College of Science and Technology—to the chair of Electrical Engineering there. He resigned from his chair at the College in 1953 to become director of research and education with Metropolitan Vickers (now AEI). Sir Willis is also the immediate past-president of the IEE.

Sir Josiah Eccles, O.B.E., deputy chairman of the Electricity Council, has been elected by the British Productivity Council as a director of National Industrial Fuel Efficiency Service.

Mr C. C. Miller has been appointed deputy chairman of Earle Bourne and Co., a subsidiary of Delta Metal Co.

Dr E. A. Tatford, director of contracts of the UK Atomic Energy Authority has been elected president of the Institute of Public Supplies for a second year. He has also been appointed a director of the National Institute of Governmental Purchasing Inc., of US.

Mr R. Foxwell, managing director, and **Mr G. Ball,** general sales manager of Wayne Kerr Laboratories, are now on a business visit to the USA.

OBITUARY

Mr M. J. Dark, A.M.I.E.E., formerly London director of Taylor Tunnicliff and Co. Ltd., died on 8 Dec., aged 80. He retired from that company three years ago, after 45 years as London director. He started his career with Edison Swan Electric Co. as a draughtsman, then joined British Westinghouse Co. at Trafford Pk, and from 1902 to 1908 was in charge of Johnson and Phillips' Switchgear Department. After five years with Electric and Ordnance Accessories Co. Ltd., in Birmingham, he joined Taylor Tunnicliff and Co. and took charge of the London office. Subsequently he was also a director of Electric Transmission Ltd. and Taylor Tunnicliff (Refractories) Ltd.

Mr A. Bolton, director and former secretary of Erskine, Heap and Co. Ltd., died on 4 Dec., aged 79. He was with GEC from 1895 and joined Erskine, Heap and Co. in 1907 as assistant secretary, being appointed secretary in 1918, a post he held until retiring in April, 1959. He had been a director since 1949.

Mr O. H. Layhe, O.B.E., metals controller to the BICC group until retiring last March, died on 2 Dec., aged 65. Mr Layhe joined the former BI Co. at Prescot in 1909, going in 1925 to the Newcastle sales branch office. In 1943 he returned to Prescot as assistant home sales manager and became assistant commercial manager in 1947. The following year he was transferred to London as manager (purchasing). In recognition of his services to the joint committee of the cable making industry, Mr Layhe was awarded the O.B.E. in 1956. The following year he became metals controller, and was appointed director and general manager of British Copper Refiners Ltd. He was also a director of several subsidiary companies in the BICC group.

Mr L. Jessop, A.M.I.E.E., who was formerly in business in Bradford as an electrical engineer, died on 2 Dec. on board the liner *Oriana*.

Mr J. Carson, O.B.E., managing director in charge of tube production for Stewarts and Lloyds Ltd. since 1948, died on 9 Dec., aged 69.

Visual problems on motorways

ONE of the highlights of this year's APLE conference was the paper by J. M. Waldram on a driver's reaction to what he sees when on the road both by day and by night. This masterly survey of the subject, taken both from personal experience and study of the reaction of others, was all the more refreshing in that, though the work of one intimately connected with road lighting problems over a long period, it did not approach the problem from a purely objective road-lighting viewpoint. As Mr Waldram has so often said, lighting does not directly bring about either safety or expedition; its contribution is to give to drivers at night the information which they need in order to drive both fast and safely.

Such a study is, of course, never complete and Mr Waldram took his arguments a stage further in a paper read before the Illuminating Engineers' Society in London last Tuesday when he dealt with the problem as it particularly concerned the modern high-speed motorways.

Motorway Driving

A first impression of driving on a motorway by day is that it is easier than driving in traffic routes. Despite the greater speeds, the driver has less to do, but he has to be more alert and reorganise his estimates of stopping distance to compensate for the higher speeds. The danger lies not so much in the other traffic moving with him, closing rates of which are slow in that they, too, are travelling at high speed, as in the stationary vehicle or dropped obstruction which, relatively speaking, approaches at 70 m.p.h. to 80 m.p.h. and will, in effect, plough through the cloud of oncoming vehicles like a car crashing through a car park at 70 m.p.h. Added to this is the danger of unexpected movements it will impart on other vehicles.

The greater clearances he must allow for by day means that he must fixate his vision 1,000 ft or more ahead with only casual observance of mid-distance conditions, a change of which could equally well create unexpected hazard and have to be compensated for. This, and the lower manoeuvrability at speed, means that though motorway driving is boring, the temptation to relax or even to sleep must be resisted by every means. By night on unlighted roads, the soporific effect of streams of red rear lights meandering from side to side creates an additional danger; moreover, they do not by their movement or relative position give any reliable perspective impression of distance.

Night-driving by headlights, even when conditions allow them to be used undipped and dazzle-screens mask the glare of oncoming traffic in the adjacent lane, still only gives him a visual range of 300 ft to 400 ft, part of which may be reflections from central studs. Beyond this, he must drive by red lights, the changing pattern of which he is unable to interpret with any degree of accuracy. He cannot reliably discriminate between the rear light of a car and a red light of an obstruction until too late to take safe avoiding action. Other menaces which he has to contend with is the patch of fog, which may mask one or more stationary or slowing vehicles, the obscured windscreen by mud thrown up from an overtaking car, which may take 10 sec to 15 sec to clear, and the inadequate view of rear traffic through small mirrors partially obscured by dirt, condensation, etc.

Megacandle Headlights

Vehicle headlights by themselves will never give the required range for fast night driving. The frame of reference for locating traffic on a clear night 1,000 ft ahead would necessitate headlight intensities of the order of megacandles, intolerable to other road users, even if they could be realised on the vehicle.

It is part of Mr Waldram's contention that fixed lighting on a motorway will reveal to a driver all that information which is available to him by day, no more or no less. Taking as his example the Autoroute du Sud, near Paris, he states that, despite the hazard of columns on the roadside and particularly in the centre reservation, the distance to which objects can be seen is not limited within the range imposed by topographical features, road perspective is recognisable and accidents or stationary objects can be recognised in time. The lighting also gives good warning of fog patches.

Laying down 11 basic requirements for good motorway lighting, he visualises lanterns with distribution cut-off which is not too hard, providing a little light up to the horizontal and fairly narrow in azimuth, mounted high in a single row for each carriageway at spacing-height ratio depending on the running surface but probably not exceeding 3·5.

Mr Waldram concludes his paper with some criticisms of signal lights on vehicles and recommendations for their improvement.

Imporous graphite production

OUTSIZE CARBONISING AND GRAPHITISING FURNACES

GRAPHITE, one of the many forms of carbon, occurs naturally as "plumbago" but it can also be synthesised from amorphous carbon, usually in the form of lampblack, by graphitising; that is, heating to a temperature of around 2,500°C in an inert atmosphere. In some cases the products are formed into the required shape in a plastics mix of amorphous carbon with a binder and graphitised by the passage of current through them from electrodes connected to a high-current, low-voltage transformer; in other cases they are heated in a furnace in which the walls and heating elements are of graphite to prevent contamination by other metallic impurities or oxides. Graphite so formed varies considerably in particle size and porosity.

Research workers, among whom the most famous was Dr Acheson, have spent considerable time and effort in improving both production processes and physical properties of synthesised graphite. At the same time, the fields of application have expanded from its first uses as pencil leads to lubricants, seals and glands for chemical plants, high-temperature bearings and bushes, nozzle throats for jet engines and rockets and also in the construction of nuclear reactors, for which it has proved a suitable moderator material. More recently, the application in this field has extended to graphite fuel element cans in proposed high temperature types of gas-cooled reactors such as are currently being designed in Britain, Germany and the USA.

An essential requirement is near-impermeability to gases or fluids at high temperatures. Among the methods which have been developed is the furfuryl alcohol process, originally an RAE process, which was taken up by the UKAEA at Harwell and finally developed to the present stage by the Hawker-Siddeley Nuclear Power Co. at Langley. Very briefly, the process involves the impregnation of a finished graphitic element with a low surface tension hydrocarbon and converting the latter into carbon or graphite while in the pores in a baking or graphitising furnace. The resultant product will maintain a vacuum of better than 0·01 mm mercury for several hours at 1,800°C under inert gas conditions. Another important result is that the ultimate tensile strength increases from 3,200 lb/sq in. to 5,900 lb/sq in. with corresponding improvements in flexural strength and elastic modulus.

Process Plant

The experimental furnaces on which the development was carried out are, of course, too small for full-scale production of elements used in reactors. Eighteen months ago, Hawker-Siddeley decided to order four carbonising and two graphitising furnaces for their factory at Langley, near Slough, the former to have a charge capacity 4 ft 6 in. dia by 14 ft 6 in. long and a controlled atmosphere of 1,000°C while the latter, four times larger than any yet designed, would operate at up to 3,000°C or 1,700°C at a vacuum of 0·1 mm mercury. The design was placed with Spembly Ltd., of Chatham.

The Carbonising Furnace

The carbonising furnace comprises a vertical cylinder 22 ft high by 8 ft 6 in. dia and is charged vertically through the top by means of a 3-ton gantry. The charge is contained in a muffle chamber externally heated by nickel-chrome tape elements arranged in three zones and individually controlled. A fan draws hot gases down through the charge and upwards through re-circulating ducts in the walls of the chamber. Thermocouples at selected points monitor the temperature, which is recorded on instruments at the control platform where fine temperature regulation is automatically maintained by control pyrometers. The atmosphere is inert, comprising nitrogen with an oxygen content of not more than 10 p.p.m.

The load on the furnace is 50 kVA max supplied via a tapped transformer on the 440 V three-phase supply, having secondary tappings from 33 V to 213 V.

The Graphitising Furnace

The graphitising furnace was designed to a requirement calling for a unit capable of accommodating components up to 10 ft long and capable of attaining a temperature of 3,000°C with an 800 kVA power load. This, also, is a top-entry furnace and comprises a pressure vessel lined with graphite and with graphite heating elements.

The graphite lining of the furnace comprises a base assembly of petal carbon plates in two separated layers overlapping and bolted together with graphite bolts. The wall linings comprise graphite rods circumferentially distributed with diametrical slots to take close-fitting graphite plates to form a cylindrical assembly, the jointed sections interlocking to avoid the necessity of complex threaded components. A continuous ring of L-shaped blocks at the top of the lining provides a stepped assembly which supports and provides a seal with two independent lids designed to reduce convection and radiation losses. The wide range of temperatures and long length of the interior components introduced expansion problems which complicated the sealing, but these were solved by careful design.

The heating elements are axially spaced graphite rods, placed circumferentially around the heating space. The ends of the rods are threaded and provided with conical seatings to ensure good electrical contact with the graphite ring which forms the neutral connection. They are, of course, connected in star. Power is supplied to the elements at 25 V from a special tap-changing transformer of Fuller design and manufacture on the 6·6 kV system feeding into a furnace transformer in the same tank. An 8-step coarse and 18-step fine tap-changer between them allow of 143 steps of 0·14 V to be selected, the actual selection being made by a motorised controller under the influence of the automatic temperature regulator with indicating and recording facilities. The control signal is derived from a total radiation pyrometer. Protective circuits include overload, power failure, maximum temperature trips and failure of cooling water and gas supplies.

Transformers in court

1959 PROFIT ON EXPORT OF LARGE TRANSFORMERS 2·4%.

AGREEMENT STOPS HOME PRICES FALLING TO EXPORT LEVELS

QUESTIONS about discussions to extend membership of the Transformer Manufacturers' Association continued to play a big part in the Restrictive Practices case last week. As we reported in the last issue, Mr A. R. Kevan, of the English Electric Company's transformer tendering department, had spoken of negotiations last June between individual members of the TMA and the larger manufacturers outside the Association. Counsel for the Registrar of Restrictive Practices had suggested that the object of the conversations was to drive smaller non-members out of business.

Mr Kevan was succeeded as a witness by Mr J. Dyson (commercial manager, transformer division, AEI). He said that firms who were not members of the Association had told him they always tried to charge prices as closely in line with TMA prices as possible. Sometimes they charged more, sometimes less. In connection with the meeting in Leeds in June, there was disagreement about prices and also about the sharing of business. Outside manufacturers disliked the Association rebate scheme; they suggested it should be scrapped.

Later, he denied that any attempt was made to prevent the expansion of outside manufacturers and to discourage new entrants to the industry. He denied that there was any attempt to destroy the capacity of smaller firms who were not members of the Association.

Mr Dyson said he thought meetings of representatives of members to discuss export business were helpful, but he would not be prepared to enter into such discussions with competitors at home if there were no home sales agreement.

Long-term stability was not necessary only in order to enable the transformer industry to remain in business; it was needed if the industry was to keep the confidence of its employees. Without the long-term stability which the home trade agreement gave the industry, manufacturers would not be able to attract people to work for them. Furthermore, it was only by having a stable home market that they were able to keep capacity for the variable quantity of export business which it was in the country's interest to take. Engineering and manufacturing knowledge was the same whether the transformer was being built for the home market or for the export market.

Mr Dyson was asked by the President of the Court, Mr Justice Russell, whether he thought it would be a good thing if the smaller manufacturers were driven out of business. He said he did not. They had an important function to fulfil in the industry within a limited range. Their diversification helped to keep down costs. He also said that while winners of large orders were proud to announce their success, those who received small orders were not so keen on other companies knowing.

Profit on large transformers exported during 1959 was only 2·4%, he said later. If the TMA agreement were ended, any intensification of competition might force down export prices and remove that small margin.

Accountants and Economists

A sidelight on the difficulty of operating the agreement was cast by Mr W. E. Carnelley, an accountant who dealt with adoption of a common form of preparation and presentation of costs by TMA members in arriving at the prices. He said it was difficult to convince engineers, who had been used to slide rules and making estimates, of the need to discuss costs with accountants; and it was equally difficult to discuss with accountants what was the best method of estimating overheads in costs. He agreed with counsel that figures before the Court showed that the most profitable and consistent section of business in the home trade was in large transformers. There had been a decline in profitability in all sizes of transformers in both home and export trades since 1955.

An economist from Oxford University, Mr G. B. Richardson, told the Court that export prices for large transformers had been falling and that without the TMA agreement home prices would have tended to fall to the same level. He said excess production in some years was the price transformer manufacturers had to pay for meeting the peak demands. Features of the industry were fluctuating demands, substantial fixed overhead costs and the fact that transformers were for the most part made to order, not for stock. Questioned about the possibility of a price notification scheme as an alternative to price fixing, he said it was conceivable but would inevitably be elaborate. He thought that abandonment of the present agreement would inevitably lead to greater instability in prices.

Mr Richardson told counsel for the Registrar that he could think of several industries besides transformer manufacture where fluctuations in orders occurred, but in those industries the effect was different. He said members of the TMA adhered to the price-fixing agreement "very substantially." Without the agreement, it was within the power of the electricity supply authorities to drive prices down.

After Mr Richardson had given evidence, counsel for the Registrar began his address to the Court.

The case so far . . .

The ten-member Transformer Manufacturers' Association is defending before the Restrictive Practices Court its agreement providing minimum prices for transformers sold for use in the UK. In the opening statement on behalf of the Association, much was made of the need to have such an agreement if there was to be a parallel agreement for co-operation in the export field. The need to co-operate as a source of strength in bargaining with the supply industry was also stressed. Witnesses for the Association have drawn attention to under-employment of the capacity of the industry at present and have underlined its difficulties in selling overseas. They have also described tentative negotiations by individual members with non-member firms in an attempt to extend Association membership. The case began on Monday, 21 November, and is expected to continue for some time.

equipment for industry

Unusual potentiometric recorder

CONVENTIONAL potentiometric methods for measuring voltages, while extremely accurate in principle, suffer from the inherent possibility of error due to slide-wire wear. The principle is retained in a recently introduced instrument for continuous chart recording of d.c. voltage outputs, but with the elimination of the traditional slide-wire. Instead, a fixed resistor is used, across which the voltage to be measured is connected, the necessary balance voltage being obtained by passing a variable current through the resistor. Key to the method is the use of a force-balance transducer, an electro-mechanical device by which current can be varied. This is connected in series with the fixed resistor and a stabilised voltage d.c. supply. During measurement, out-of-balance voltage signals, suitably converted and amplified, are fed to a servo-motor. This drives the force-balance transducer clockwise or anti-clockwise through a given angular rotation until null-point balance is achieved. The servo-motor also drives the chart printing head which thus registers on the chart the appropriate balance voltage. One version of the instrument available, using a 10½ in. wide chart, has provision for 12 input channels. These are cyclically switched at five-second intervals, giving one reading every minute for each channel. There are six chart speeds, allowing a minimum of one week and a maximum of four weeks recording time for the standard chart length. The instrument has a variable input range with a minimum of 0 to 1 mV and is suitable for recording outputs from thermocouples, strain-gauges and other transducers. *Smiths Industrial Division, Kelvin Hse, Wembley Park Drive, Wembley, Middx.*

Vapour cooling valves

NORMAL methods of cooling industrial thermionic valves, either by air-blast or water circulation, are not always suitable. Examples are in polluted atmosphere conditions and where there is a limited supply of cooling water. An alternative method, which has been applied to cooling oscillator triodes of an induction heater, makes use of latent heat of absorption due to vaporisation. In essence, the cooling unit consists of a jacket, filled with distilled water, surrounding the valve anode cap and integral with a condenser. Anode dissipation boils the water at atmospheric pressure, the steam being condensed and the condensate returned to the jacket in a continuous cycle. The anode temperature is thus maintained at 100°C. *English Electric Valve Co. Ltd., Chelmsford, Essex.*

Liquid level controller

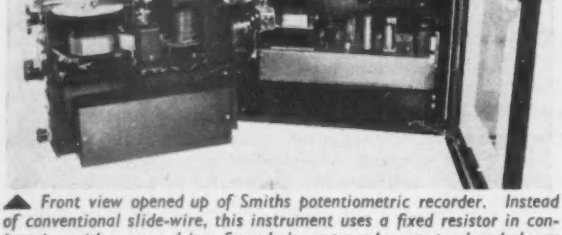
A LEVEL controller for conducting liquids, the "Resistron," makes use of the liquid to complete the circuit of a single-valve amplifier which, in turn, actuates a control relay integral with the unit. This is done by means of electrodes fixed at the high and low levels, there being different types available for various liquids, including acids. The relay incorporates one normally open and one normally closed pair of contacts, rated at 5 A, 250 V. These can operate a visual or audible alarm or appropriate control circuit. The device is suitable for liquids having a specific resistance of not more than 50 kilohms/cm. cube and can be applied to boiler level control and indication. Supplied with sheet-steel or cast-iron case complete with green and red warning lights, the unit has dimensions 4¾ in. by 6¼ in. by 4½ in. It is available for 110 V, 240 V and 440 V supplies at 40-60 c/s. *Thomas Industrial Automation Ltd., Station Bldgs, Altrincham, Cheshire.*

Silicone fluids price cut

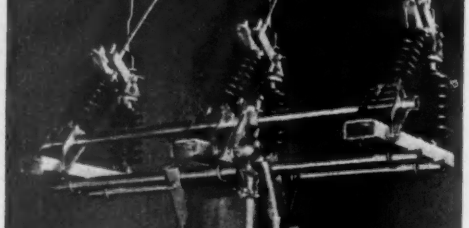
PRICE reductions have been announced for "Amersil Electrospray," a phenyl-methyl silicone protective fluid. Its purpose is to prevent tracking in electrical equipment such as might occur between exposed connections and contacts. This it is claimed to do by repelling condensation and, at the same time, sealing off components against corrosion. The fluid is low volatile, has a low surface tension together with a freezing point of −58°F and a flash-point of 575°F. Available in a 12 oz aerosol spray container, new price is 20s/container bought singly and 15s/container in 12 dozen lots. Also reduced in price is "Ambersil Formula One," pure methyl silicone, whose principal application is that of an anti-stick agent for releasing die-casting moulds. *Amber Oils Ltd., 11a Albemarle St, W.1.*

11 kV o/h line isolator

UNIQUE feature claimed for a new 11 kV pole-mounted isolator of the rocking type is the use of rotating—instead of the usual push-rod—operation. This is said to give advantages of simplicity and low cost. The insulated control rod is supported parallel to the pole on pedestal type bearings and has a freely attached operating handle. In operation, the handle is swung out at right angles to the rod and rotated in the horizontal plane. The isolator can be padlocked in the open or closed condition, using the handle in effect as a hasp. Another advantage of the new design is the use of universal supporting steelwork for mounting in either horizontal or vertical positions, and for use with either two- or three-insulator switches which are available. In addition, mounting is suitable for either single- or H-poles. The U-shaped fixed contact jaws are claimed to give increased pressure with increased current, while cylindrical moving contacts can be rotated to give uniform wear. Nominal current rating is 400 A. Four types of insulator are available. *Switchgear and Equipment Ltd., Southam Rd, Banbury, Oxon.*



▲ *Front view opened up of Smiths potentiometric recorder. Instead of conventional slide-wire, this instrument uses a fixed resistor in conjunction with a servo-driven force-balance transducer to produce balance voltages. Drive mechanism is seen on left with servo-motor amplifier and stabilised power supplies on right*



Switchgear and Equipment Ltd. 11 kV isolator. Special feature is adoption of a rotating-rod to open and close the switch ▶

for the electrical trade

Heating on the skirting

A SYSTEM of skirting board heating employing short, simply installed sections is available. It is based upon the "Inferation" element—a resistor of silverised carbon spluttered on to sheets of resin-bonded fibreglass. The element used in this system is completely enclosed in this material and is thus insulated by it. The short sections of about 50 W/ft run are in two parts, first, the rear panel which houses the element and embodies all attachments for fixing and interconnecting and, second, the front "sculptured" face which is screwed into place after installation of the rear. The front shield mentioned above provides inlets at bottom and top for the passage of air.

Sections are supplied primed ready to take any type of paint desired. Short sections of wood having identical profile can be supplied to fill in corners and odd spaces. These incorporate channels to take the connecting cable. Cost, including purchase tax, is 24s 11d/lin ft. *Inferation Ltd., 12 Copthall Court, E.C.2.*

Sweeps, scrubs and polishes

A MULTI-PURPOSE floor-cleaner, "Triumph," was introduced recently. This commercial machine vacuum-sweeps, scrubs, polishes and sands by the simple attachment of a number of accessories. It is notable for its lightness in use and, in fact, requires an extra clip-on weight for heavy jobs like scrubbing and sanding. Its motor of 500 W rating with direct drive has no belts, gears, pinions or friction drive. In addition to the clip-on weight its attachments are oscillating splayed brush, 7½ in. dia, suction impeller, and scrubber. "Triumph" is guaranteed for two years and is covered by a country-wide after-sales service. *Progress (Universal) Ltd., 590 Wandsworth Rd, S.W.8.*

TRADE PUBLICATIONS

ATE.—16-page coloured brochure on sound systems — including broadcasting, music, radio, intercommunication, noise detecting and locating. Communication Systems Ltd.

FALKS.—Ten-page brochure "Falks Lighting Service" describing lighting systems for public buildings, stores, schools, etc. Falk, Stadelmann and Co., 91 Farringdon Rd, E.C.1.

HONEYWELL.—Seven-page illustrated booklet on domestic heating controls. Honeywell Controls, Ruislip Rd East, Greenford, Middx.

BULGIN.—News Bulletin No. 33, Volume 3, 1960. A. F. Bulgin and Co., By-pass Rd, Barking, Essex.

I.I.H.C.—Reprint of article on Refractory Suspended construction, presented to the joint meeting of Society of Furnace Builders and Society of Glass Technology, April, 1960, by W. S. Sinclair. "Icanite," a leaflet on special process cast iron for press tools hardenable by standard methods. The Incandescent Heat Co., Smethwick, Birmingham.

HARVEY.—Brochure entitled "The Harvey Team," describing activities, products and personnel, 1960. G. A. Harvey and Co. (London) Ltd., Woolwich Rd, S.E.7.

DU PONT.—Technical information bulletin on Elastomers—neoprene, "Hypalon" and "Viton," their properties and applications. No. 16, 1960. E. I. Du Pont de Nemours and Co. (Inc.), 76 Jermyn St, S.W.1.

C.M.C.—Folder describing diffusing panels of various shapes for use with fluorescent tube lighting, entitled "Lighting Bricks." C. M. Churchouse, Clarendon Wks, Clarendon Cross, W.11.

P.C.—Four-page leaflet, LT2 on industrial lighting trunking and power tap system. Also price list, for Sept., 1959. The Power Centre Co., Wednesbury, Staffs.

ALMA.—Reprint of four-page article entitled "Precision Wirewound Resistors, Their Design and Manufacture," by D. C. F. Bartlett, B.SC.(ENG.), from Radio and Electronic Components, May, 1960. Also list of extensions of ranges and improvements in tolerances of resistors by Alma Components Ltd., 551 Holloway Rd, Holloway, N.19.

REIGATE.—Latest issue of Domestic Apoliance Catalogue by the electrical and radio wholesalers Reigate Electrical Co. (Wholesale), 61 London Rd, Reigate.

COLUMBUS.—Leaflet and price list of automatic time-lag switches from Denmark. Elkay Electrical, 42 Woburn Pl, W.C.1.

Transatlantic blender

A SERIES of American domestic mixer and blender appliances is to be imported into this country and the first, a blender, will appear early next year. This blender, to be marketed under the "Waring" trade mark, comprises a circular metal stand, housing the motor unit and a tall, lidded "Pyrex" container which fits on to this. Rotating blender blades are built into the bottom of the container by means of a leak-proof bearing. When the container is placed on the stand a chuck on its underside engages a drive stud. The blender is used primarily for reducing vegetables to purée or fragments to produce sauces, though it will perform a host of other odd jobs like grinding meat, mixing batter and shaking cocktails. A special attachment converts it into an ice crusher.

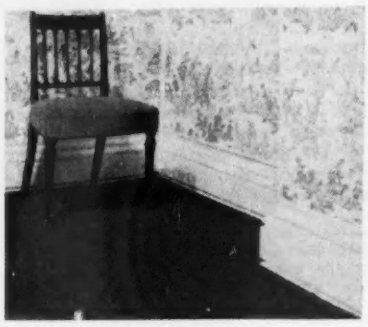
The self-lubricating motor has two speeds controlled by a switch in the base. Its housing is white, green, yellow, pink and turquoise plastics, or die-cast in chrome finished steel, copper or brass. Single-speed model is expected to sell at £15 9s 9d tax paid, the double-speed at £17. *Winston Electronics Ltd., Waring Products Div., Shepperton, Middx.*

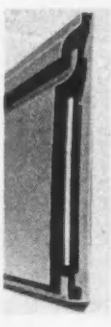
Drying panel price cut

THE 600 W "Inferation" clothes drying heater has been reduced in price. This dryer comprises four hinged panels, each incorporating a separate element, which fold into a slim wall-mounted panel. It has been reduced from £24 5s to £19 19s, tax paid. *Inferation Ltd., 12 Copthall Court, E.C.2.*

New extractor fan

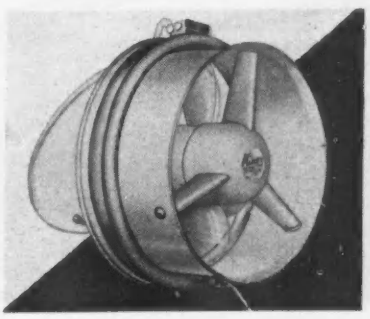
NEW in the domestic extractor fan field is the Minex Mark III "Super." Careful design of the four-bladed impeller, allows normal extraction rate of 20,000 cu ft of air/hr to be carried out at slower rotation speed and consequently, it is claimed, with less noise. Other features of the new fan are a transparent adjustable outer shutter and moulded rubber gasket for window fitting, which simplifies installation. Motor characteristics are such, it is claimed, that even when the external louvre is completely closed, the unit cannot overheat. It sells at £6 19s 6d. A reversible model is available at extra cost. *Jones and Stevens, P.O. Box 35, Eastern Bypass, Littlemore, Oxford.*





◀ *A cross-section of an inferation skirting heater, showing plastics-based spluttered element with front face fixed in position. Larger picture shows complete installation*

Minex "Super" extractor fan. It has four blades, and is claimed to achieve normal extraction at a slower speed. £6 19s 6d ▶



SILICONES IN ENGINEERING

APPLICATIONS of silicones in engineering are discussed in a paper by Mr C. A. Grinham, B.SC.TECH., A.M.C.T., (Midland Silicones) presented to the Manchester Association of Engineers last week. He opens his paper by observing that since silicones became available in commercial quantities only ten years ago, they have achieved over 400 known applications in over 20 separate industries.

Silicones may be split into three categories when their applications in industry are under discussion: silicone fluids, silicone resins and silicone rubbers. Fluids are of two types, chemically distinguished as dimethyl fluids and methylphenyl fluids. In general, the latter possess better oxidation stability, better lubrication properties and, in certain cases, lower freezing points.

Fluids

The fluids have excellent viscosity/temperature characteristics, inertness and low temperature properties, which make them particularly suitable for use in damping devices, their application to dashpots in electrical switchgear being an offshoot of this. The dielectric properties, combined with the inertness, heat stability and low volatility, make them suitable impregnants for metal foil capacitors, and appropriate for use as transformer coolants. On the mechanical side, the impressive temperature range of −40°C to 200°C is quoted for a lubricating grease formed from a medium phenyl content silicone fluid which is filled with lithium soap.

Resins

Silicone resins find direct application in electrical equipment, particularly where high temperatures are to be withstood. The paper makes the point that the good temperature characteristics may be used either to permit normal life at elevated temperature or to give enhanced reliability where ambient temperatures are not unusually high. Again, ability to operate at high temperature with normal life may be used to permit weight-saving through construction of more compact electrical machines.

Finally in the list, silicone rubbers have obvious electrical applications. In the form of sleeving, they are used to replace organic rubber or p.v.c. sleeving where temperatures are high, where miniaturisation causes difficulties with p.v.c. in soldering operations, and where tropical ageing causes deterioration of the p.v.c. or organic rubber.

Silicone rubber insulated cable is used for both high and low—as in aircraft—temperature applications. Since silicone rubber burns to silica, it can operate through a fire with some temporary retention of insulating properties ensured.

Cold-curing rubber

A recent development in silicone rubbers concerns cold-curing rubber. These are fluid or semi-fluid materials which on addition of 1% to 4% catalyst cure to rubber-like solids at room temperature in a matter of 30 min to four hr. Although they possess the usual temperature resistance of silicone rubbers, they are not so strong mechanically. Their uses include application as mould materials in which epoxy resins may be cast and the potting and pre-potting of electronic components.

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s.s. *Oriana*

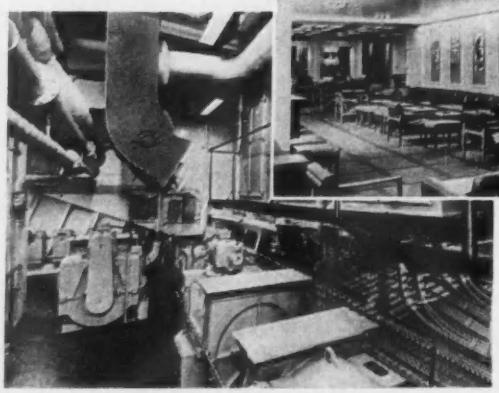
MORE ELECTRICAL DETAILS

MORE information on the electrical equipment on the s.s. *Oriana*, the maiden voyage of which was reported last week (page 890) is now to hand.

Messrs Laurence Scott and Electromotors are among the manufacturers supplying the electric motors, generators and control gear. Their contribution includes the three 300 h.p./200 kW motor-alternators for the fluorescent lighting installation, 10 h.p. and 20 h.p. boat-davit motors and the steering gear motors. The latter are two of 120 h.p. and one of 55 h.p.

The a.c. circuits are supplied at 230 V, three-phase 50 c/s and all motors are of the drip-proof enclosed ventilated type.

For the lighting of the *Oriana*, some 14,000 fittings, including nearly 100 special designs, have been supplied by the GEC in addition to the hot-cathode and cold-cathode fluorescent installations in the major public rooms. The GEC is also responsible for the extensive internal telephone system, fire alarms and room switches, push-buttons, etc. Among the special lighting effects is the illumination of the John Piper mural in the Princess Room.



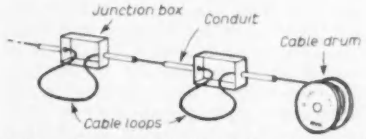
GEC hot cathode fluorescent lighting in the Monkey Bar

The fluorescent lighting is on a.c. circuits fed from these 200 kW alternators

Concealed GEC cold cathode fluorescent lighting has been chosen for the Princess Room with tungsten filament spotlighting for the John Piper mural

PROBLEMS AND PRACTICE

We welcome contributions to this feature; those published will be paid for at our standard rates. There must be many problems encountered in day-to-day electrical work, or useful ideas or tools devised to make it easier; all make instructive reading.



Taking the cable off the coil or drum and feeding through the conduit run before cutting saves time and cable

Wiring off the Coil

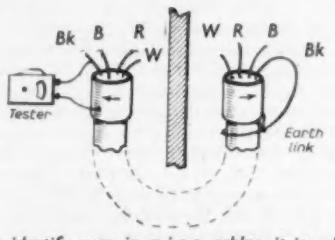
RECENT increases in electricians' wages emphasises more than ever the need to conserve labour and materials. A frequent source of waste on wiring with v.r.i. or p.v.c. cables in conduits arises from the practice of measuring the run—and sometimes remeasuring it—transferring the length to the cable on the reel with a little added "for luck" before cutting off. When all is installed, the waste in cutting ends plus the occasional length which, somehow, was too short, is considerable.

Working from the coil saves a lot of useless measuring time and cuts waste cable to a minimum. The coils are supported on a rod and enough pulled off and fed through the conduit run to reach the farthest end. Loops are then pulled at the intervening cable boxes and connections made at each station working from the far end. Excess cable is pulled back towards the coil and rewound when the last junction is complete.

This method has the additional merit of ensuring that the cables enter the conduit free from twists, and two or more cables can be inserted and run together from separate coils on the same supporting rod.—*M. Neidle.*

Core Identification

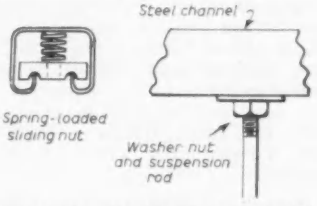
A DIFFICULTY which arises when installing multi-core mineral-insulated cables is that of "colour" identification of the cores, particularly when the ends of a run are distant from each other. It is usually done by earthing each core in turn and ringing through or using a megger. A method I use is to first make off one end complete and identify the cores by whatever colours are being used. For example, in a four-core cable they would be identified as black, red, white and blue, in a clockwise direction. Before leaving this end, I earth the black core and leave the others clear. The far end is now sealed off and either megger tested or rung through to find the earthed core, this, of course, being labelled black. It is now a simple matter to label the remaining cores in order in an *anti*-clockwise direction to give red, white and blue. This method can be used regardless of the number of cores since they must maintain their relative positions throughout the cable run.—*M. McGee.*



To identify cores in m.i.c.c. cables, it is only necessary to "ring-through" on one, other cores are in order

Lining up Trunking

NO matter how carefully the chalk string is used to lay out trunking suspended from a concrete ceiling, variations always creep in, if only through pebbles in the concrete, in the positioning of suspension rod fixings. By using short lengths of steel channel, such as are used for cable racks, secured to the ceiling at right-angles to the run of trunking, together with the appropriate spring-loaded nut in the channel, carrying the threaded suspension rod and locknut, it is an easy matter to line-up the trunking after erection. The height of the trunking can also be easily adjusted if a suspension stirrup and threaded rod are used.—*F.S.*

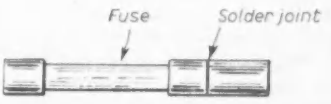


Lining up of trunking drops is facilitated by fixing short lengths of channel to the concrete ceiling

Temporary Fuse

SOME specialised equipment uses aircraft-type cartridge fuses, replacements of which may not always be immediately available. Fuses to BS 1362, as used on ring circuits, are of the correct diameter and rating but are too short. In such an emergency, I cut a short length of ¼ in. brazing rod square at one end and tinned the end surface. The end of a fuse was also carefully tinned with soft solder, taking care not to overheat it. With the short rod held vertically in a vice and heated until the solder melted, the flame was taken away and the fuse end applied to the rod and held in position until the solder solidified. The residual heat in the rod was sufficient for the purpose. Afterwards the rod was cut to length to suit the holder.

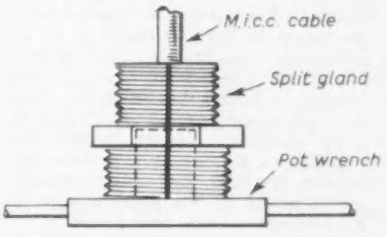
It may be as well to mention that the rating of the fuse is not necessarily suitable for a d.c. supply unless it is at a low voltage.—*Ubique.*



A domestic fuse can be lengthened in an emergency to fit cartridge clips designed for aircraft-type fuses

Pot-wrench Tip

USERS of m.i.c.c. cable will be familiar with the comparatively recently introduced pot wrench and will have found it a great advantage over the former practice of screwing the pot on to the cable with pliers. Used in its intended manner, however, a gland is always employed but there are, of course, many situations where a gland is not required. To meet these cases it is an advantage to have a gland body which has been split in half from top to bottom. Using this in association with the wrench, the pot can be applied to the cable after which the split gland body can be removed for further use as and when necessary.—*J.S.B.*



A split gland enables a pot wrench to be used to screw pots on to m.i.c.c. cable where glands are not required

News of the Week

CONSENT SOUGHT FOR WYLFA

Nucular station, possible of 800 MW, by 1967 proposed

CONSENT for a nuclear power station of a capacity not exceeding 800 MW is being sought by the CEGB. The Board is applying to the Minister of Power and the local planning authority, Anglesey County Council, with a view to having the station in commission in 1967. The selection of the Wylfa site for the second nuclear power station in North Wales was announced by the CEGB last July and there has been but little opposition to the proposal. Actual site of the station is likely to be near Cemas Bay on the west side of the head.

It is planned to connect the station to the national grid at 400 kV so as to minimise the number of transmission lines required. Routes for these lines will shortly be discussed with the local planning authorities and others concerned, prior to application for consent for the lines being made to the Minister of Power. Discussions have already begun on the particular problem of where to cross the Menai Strait.

Meanwhile, Anglesey County Council officials have asked the CEGB to consider the possibility of laying a submarine cable across the Strait, and although the Board have indicated that such a scheme has serious difficulties, they are prepared to consider it.

Anglesey officials point out that sea cable power transmission will be utilised in the cross-channel cable link. The Council may press this alternative to the overhead transmission line when the CEGB makes formal application for approval.

If consent is granted, Wylfa will be the CEGB's eighth nuclear power station. Those already under construction are Berkeley, Glos (275 MW); Bradwell, Essex (300 MW); Hinkley Point, Som (500 MW); Trawsfynydd, Merioneth (500 MW); Dungeness, Kent (550 MW) and Sizewell, Suffolk (580 MW). Consent was recently given for Oldbury-on-Severn, Glos and inquiries have been issued.

Petition against "Everest" appliance firm

A PETITION for the winding-up of Merseyside Engineering (Refrigeration) Ltd. has been put forward by the West German firm Hans Liebherr, with which the company has been linked. The petition is to be heard at the Royal Court of Justice on 19 Dec.

Merseyside Engineering, who market the "Everest" range of refrigerators, washing machines and heating appliances, were linked with the West German firm under a merger through a Swiss holding company, Libholding, as we reported on 16 June. In Western Germany, Liebherrs were reported to be the fourth largest manufacturers of refrigerators. Under the arrangement, Merseyside Engineering (Refrigeration) planned to build a new factory in Caernarvonshire and, last July, Mr C. Angelis, joint managing director, stated that negotiations for the factory were proceeding, for they considered that difficulties caused by h.p. restrictions would be overcome in the near future.

The Liebherr organisation, which also manufactures cranes and building equipment, has eight factories in Germany and others in Ireland and South Africa.

Four-day week at Hotpoint factory

IN the New Year, AEI-Hotpoint Ltd. are to introduce a four-day week for some 650 workers (about a quarter of the employees) at its main manufacturing centre at Peterborough, which is largely concerned with refrigerators. Full-time will continue at Keeley St, Birmingham, where kettles, fires, convectors and other small appliances are produced, and at Llandudno, where the "Supermatic" washing machines are made.

Although the company claims that it had a relatively small share of the large stock of refrigerators in the pipeline, its sales have been affected to a certain extent by dealers' reluctance to order while carrying large stocks of other models.

New A.E.I.-G.E.C. company to lift glass-tube output

AEI Lamp and Lighting Co. Ltd. and the General Electric Co. Ltd. are to form a company early next year to take over their glass manufacture and glass sales. This new concern will take over all the glass manufacture of the two firms (other than that covered by Glass Bulbs Ltd.) and including the AEI glass works at Chesterfield and those of GEC at Lemington-on-Tyne and Wembley.

This move is in line with past policy. Glass Bulbs Ltd. was formed jointly in 1946 to manufacture the popular sizes of bulbs on a more economical basis, with a new factory at Harworth equipped with the most modern plant. The present broad plan is to considerably increase the glass tubing facilities at Chesterfield and to further develop the Lemington factory as a special glass, hand-fabricating factory. The Chesterfield expansion includes the installation of a new furnace to raise tubing output over 50%.

PORTSMOUTH REINFORCEMENT

A NEW 275 kV transmission line between an existing substation at Fleet to a proposed new substation at Lovedean, is part of a £3 million scheme to link the Portsmouth area more closely with the supergrid system by the end of 1963. Power will be fed from the Lovedean substation to Portsmouth over two existing lines to the Wymering substation and to Fareham and Havant via new 275 kV lines. Informal discussions on the scheme have already taken place with authorities, landowners and occupiers.

LINE ERECTION FIRM APPEALS

SHOULD an overhead line erection firm be allowed to use existing buildings in open country as a stores and maintenance depot? That was the question posed at an inquiry at Castle Donington recently. Riley and Neate Ltd. were appealing against Leicestershire County Council's refusal of planning permission for the use of a group of buildings in part of the disused airfield at Gimbro Fm, Castle Donington. Giving evidence, Mr R. J. Henry, a director and secretary of the company stressed that transmission lines are, in effect, a rural industry—perhaps more of a rural industry than were broiler houses. The firm was unaware at the time of occupation of the premises that they were subject to any planning restrictions. He contended that if the amenities of the area were affected it was by the buildings, rather than by the firm's use of them. In view of the importance of their work, of direct benefit to the agricultural community, the firm asked for sympathetic consideration and, if the Minister was unable to support the appeal in full, they suggested a limited consent for five years. Area planning officer for the County Council, Mr R. E. Tustin, maintained that the site was unsuitable for the establishment of an industrial use of the kind proposed as it was situated in pleasant open country. To permit such development even on a temporary basis would render it difficult for the planning authority to resist similar applications.

The Minister's decision is to be made known later.

Thermo-electric 'fridge on the way

THE day of the household refrigerator operating on the thermo-electric principle looms nearer. With the aim of expediting its development, the General Electric Co. (who have led the experimental work so far) have entered into an agreement with A. B. Electrolux, of Sweden, parent company of Electrolux Ltd., of Luton, and in Stockholm last week the latter concern demonstrated a small box cooler which has been evolved. This has an internal volume of about 0·7 cu ft and is intended mainly for picnics, camping, and for use in cars and boats. It is battery operated and consumes 25 to 30 W. The temperature in the box is 35 to 55°F below the ambient temperature. The cold generator is made up of about 100 thermo-electric elements pieced together in thin blocks no larger than a matchbox. The unit is light, silent and, having no moving parts, should have a very long life.

Although there is still some way to go before domestic refrigerators employing the principle are evolved, the collaboration of Electrolux should hasten the process and the latter concern believe that they "might become an economic proposition in the not too distant future."

It is anticipated that, initially, such refrigerators will be in the 1-2 cu ft capacity range, and their price should be no greater than conventional models, with both GEC and Electrolux marketing their own designs.

The principle of thermo-electric cooling will be already familiar to our readers—the system was explained in our 26 Nov., 1959, issue—and, on 10 Nov. last, the first of a range of the small cooling units being marketed by the GEC subsidiary, Salford Electrical Industries Ltd., intended for electronic applications, was illustrated.

Mr Wood told of Lake District hold-up

THE hold-up of the final stage of the Lake District electrification—at Borrowdale—was discussed at the recent meeting of the North Western Electricity Consultative Council when Mr Richard Wood, Minister of Power, attended. He was told that people outside the Lake District were interfering in plans to provide electricity supplies to people who lived there. The latest hold-up follows a disagreement on whether certain lines should be underground or overhead (to which we referred on 20 Oct.).

Mr Wood said he would see what could be done to hasten an inquiry into the deadlock which had halted the final stages of the scheme.

A.S.E.E. MEETINGS OPEN TO NON-MEMBERS

AS an experiment, the ASEE is throwing open its National lectures in London to non-member engineers and technicians, whether accompanied by an ASEE member or otherwise. This arrangement is made possible by a 50% increased capacity in seating accommodation at the main venue of the lectures. The next meeting is at the IEE lecture on 20 Dec. (6.30 p.m.), when Mr D. H. Powell will speak on "The Electrical Control of Heating and Air Conditioning Plant."

Volex acquire "Temco"

MAKERS and distributors of "Temco" electrical accessories, TMC-Harwell (Sales) Ltd. have been purchased from its parent company, Telephone Manufacturing Co. Ltd. (recently acquired by Pye Ltd.), by Volex Electrical Products Ltd., of Manchester. The latter concern will continue to market the well-known "Temco" range of accessories under that name, and production is being transferred to the Pendleton and Atherton factories. Correspondence concerning supplies should continue to be sent to the TMC-Harwell (Sales) London office at 37 Upper Berkeley St, W.1. It has not yet been decided whether to form a new company to carry on the business.

APPLIANCE DELIVERIES AGAIN DOWN FOR JULY-SEPTEMBER

THE latest statistics of domestic electric appliance output in the third quarter of 1960, given below, includes for the first time direct comparisons with the corresponding quarter of 1959. As a result a clear indication is again given of the affect on production of the hire-purchase restrictions, and it will be seen that the largest reduction has been in respect of spin dryers (77% down) with washing machines 62% down on home deliveries. Furthermore, last year's release of pent-up demand caused import of appliances to rise from £5·1 million in 1958 to £11·9 million in 1959, with many foreign manufacturers gaining a foothold in the UK market, particularly for refrigerators, which they are now trying to hold in a market of intense competition.

Although UK export deliveries show encouraging increases it will be seen from the table that these do not have sufficient impact on total output to enable manufacturers to combat the loss of economies of large-scale production caused by contraction of the home market. BEAMA have already urged the government to improve the hire purchase situation by adopting a 10% deposit with repayment over three years for major appliances at present subject to 20% deposit and with existing repayments over two years.

MANUFACTURERS' DELIVERIES OF DOMESTIC ELECTRICAL APPLIANCES FOR JULY-SEPTEMBER 1960

	Home			Export			Total		
		Value			Value			Value	
	Number 000s	£000	% change on 3rd quarter 1959	Number 000s	£000	% change on 3rd quarter 1959	Number 000s	£000	% change on 3rd quarter 1959
Washing machines with electrical agitation:									
(a) with hand or power wringer	68	2,469	− 63	19·3	509·1	+ 10	87	2,978	− 58
(b) with spin dryer	91	4,740	− 7	35·6	1,152·5	+ 60	127	5,893	+ 1
Wash boilers (up to 10 galls.)	47	321	− 15	0·3	2·5	− 7	47	324	− 14
Spin dryers	16	242	− 77	4·9	61·5	− 48	21	304	− 74
Heated tumbler dryers	3	91	− 46	2·5	57·2	+1171	6	148	− 14
Irons: (a) non-automatic	49	34	− 15	14·9	9·9	+ 52	64	44	− 4
(b) automatic	490	878	+ 2	131·0	194·1	− 6	621	1,072	+ 0·3
Vacuum cleaners	241	3,286	− 28	73·4	642·9	+ 63	314	3,929	− 21
Floor polishers and scrubbers	5·3	76	+ 12	15·1	132·3	+ 5	20	208	+ 7
Domestic refrigerators	144	n.a.	n.a.	25·6	n.a.	n.a.	170	n.a.	n.a.
Cookers: (a) below 5 kW	27	326	− 4	1·7	14·5	− 13	29	341	− 4
(b) 5-12 kW	120	4,241	+ 19	4·3	114·6	+ 22	124	4,356	+ 19
Food and drink mixers up to 3 quarts, including hand held	35	402	+ 28	21·4	244·2	+ 19	56	646	+ 24
Toasters	39	119	− 23	17·9	55·1	− 6	57	174	− 19
Immersion heaters up to 3 kW	207	317	+ 6	4·0	7·3	+ 9	211	324	+ 6
Storage heaters up to 30 galls.	39	419	+ 6	3·0	36·8	− 35	42	456	+ 1
Space heaters up to 3 kW	759	2,974	+ 29	23·7	78·4	+ 20	783	3,052	+ 29
Electric blankets	558	1,442	+ 47	2·3	5·6	− 16	560	1,448	+ 47
Hand hair dryers	106	192	− 4	18·7	34·4	+ 99	125	226	+ 4
Dry shavers	283	1,048	+ 5	114·3	213·9	− 11	397	1,262	+ 2

TARIFF RISE SOON IN EAST MIDLANDS

LATEST news of impending tariff rises comes from the East Midlands. Mr N. Marsh, chairman of EMEB, told the Consultative Council at Nottingham last week that tariffs would have to be increased by next April at the latest. Tariffs in the area had been unchanged since October, 1957, apart from adjustments for industrial and certain commercial consumers, he said. Since then costs had been rising continuously and now he doubted whether even the "final" rate, steady at 1d for seven years, could remain unaltered. The Board's costs would rise by about £2½ million in 1961-62 due to September's 5s rise in the price of a ton of coal, recent wage awards, higher interest and local authority rates, and the "almost certain" increase in the CEGB's bulk tariffs next financial year, Mr Marsh said. This would more than wipe out last year's surplus.

Particulars of 106 new schemes for reinforcing or extending mains, already approved by EMEB, were submitted to the Council at the meeting. Cost is estimated at £805,600, of which £485,200 will be spent on the reinforcement and standardisation of supplies. The Council decided that monthly reports and proposed new schemes should in future be submitted to its local committees for detailed consideration.

The Council is firmly supporting the National Inspection Council. A letter to be sent to all local authorities in the area pointing out the advantages of adequate installations in houses will contain an appeal to restrict invitations to tender for installation work to contractors on the NIC roll.

Another Floor-warming course

THE Borough Polytechnic is holding a short course of evening lectures on "Electrical Floor-warming and Heat Storage" on Wednesday evenings, commencing 18 Jan. Subjects to be covered include floor-warming systems, thermal storage block heaters, thermal storage water storage systems, and tariffs. Fee for the course is £1. Lecturer responsible for the course is Mr P. A. Rowland. He will be supported by eminent individual lecturers.

E.T.U. MEMBERS ALLEGE CONTEMPT

TWO members of the Electrical Trades Union have been granted leave to serve notice of motion of writs of attachment for alleged contempt of court against Mr Frank Haxell, the union's general secretary, Mr G. Scott, national officer, and the Union itself.

For the two members, Mr J. T. Byrne and Mr F. Chapple, it was pointed out that last May they launched an action against the union seeking a declaration that the purported election of Mr Haxell was invalid and seeking damages for conspiracy. Since then, Mr Haxell had circularised branches, telling branch secretaries and committee members that they were not entitled under any circumstances to hand over or disclose to other persons, branch records and documents which are the property of the union. For the two members it was submitted that Mr Haxell was telling secretaries they must not assist the plaintiffs in obtaining evidence for their action. It was also submitted that Mr Scott had been attempting to influence the officials and shop stewards to withhold evidence from the plaintiffs and not to support the latter's case.

Engineers' pay—next move

THERE are to be further negotiations on the claim for a wage increase in the engineering industry. At their meeting last Thursday the Confederation of Shipbuilding and Engineering Unions approved a resolution calling for a resumption of talks between the parties. This follows their rejection as "inadequate" the offer by the employers' side for increases ranging from 5s 6d to 7s 6d a week, to which we referred on 1 Dec.

OFFICIAL PUBLICATIONS

BS 1732. Domestic electric irons. Part I. 5s.

BS 3285. Methods of sampling superheated steam from steam generating units. 7s 6d.

BS 358. Method for the measurement of voltage with sphere-gaps. 6s.

British Council. Annual report, 1959-60. 2s 6d.

Chandos to speak

The Engineers' Guild will stage a conference on engineers' employment on 22 March at the Connaught Rooms, London. Lord Chandos, chairman of AEI, Mr A. R. Cooper, CEGB member for operations and personnel, and Mr D. J. Mann, director and head of personnel division of Unilever Ltd., are the principal speakers.

MALVERN ON STANDARD VOLTAGE

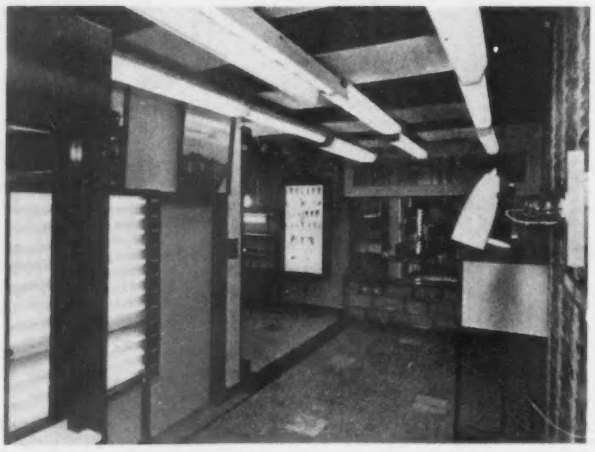
Eight-year job completed

THERE was a time when MEB engineers at Malvern used to follow the fire brigade as a matter of course, because the old 20 kVA transformers in street kiosks used to catch fire regularly—but that has come to an end. The eight-year job of modernising the town's distribution system has been completed. Fuses at the home of the last consumer to have the 200 V supply converted to 240 V were changed over by the chairman of Malvern UDC last week.

Mr W. S. Lewis, chairman of MEB, presented the consumer with an electric fire and said, at a luncheon at the Abbey Hotel later, that Malvern had been one of the few places where at times they had been forced to limit new load because the system would not take the strain. Improvement at Malvern, one of the biggest problems facing the Board on its formation in 1948, had taken longer than the five years he had hoped for, but had been accomplished at the original estimated cost of £500,000. Capital invested in the Malvern distribution system when MEB took over was £122,622, about a quarter of that spent on the standardisation scheme alone. Meanwhile, Malvern consumers had paid the tariffs common to the whole area, averaging 1·45d a unit, against 4·8d for domestic consumers in Malvern in 1938.

Mr E. C. Watson, manager of MEB's Worcester and Malvern district, said the new system had involved laying 38 miles of 11 kV underground mains and providing 119 new substations, as well as a primary substation and a 66 kV line to bring supplies from Worcester.

Atlas Lighting in Glasgow



The interior of the new showroom of Atlas Lighting Ltd., recently opened at 9-15 Waverley St, Glasgow S.1

£2¾ million supergrid reinforcement

THE 275 kV supergrid system of the South of Scotland Electricity Board is to be further extended in the Edinburgh area, from Kaimes to Dewar Pl, by means of underground cables and constructing at Dewar Pl a new supply point capable of handling 120 MW at 33 kV. A new distribution system from this point will be established to feed 17 existing 33/6·6 kV substations. Fifteen new similar substations will be constructed and the transformer capacity of five others increased. The Board's 275 kV supergrid plans, announced in November, 1958, provided for encirclement of the industrial belt of Scotland, connecting with Edinburgh at Kaimes. The Kaimes/Wishaw and Kaimes/Kincardine sections were initially to be of single circuit construction on double circuit towers, but it is now necessary, as part of the reinforcement scheme, to string the second circuit when the lines are being erected. The Kaimes/Wishaw line will be routed north of the Pentland Hills and the Currie/Kaimes 132 kV line dismantled. The Kaimes/Kincardine line will be routed by way of Currie and Bathgate so as to be available for future loads in those vicinities and between Falkirk and Grangemouth in order that the growing load in Grangemouth may at some future date be transferred to the supergrid system. Cost of the scheme is over £2¼ million and the work will be spread over the next five years.

MAINTENANCE EXHIBITION

THE first national Maintenance Conference and Exhibition is to be held at Central Hall, Westminster, S.W.1, on 13 to 16 Nov., 1961. Apart from the exhibition of equipment itself (space for which is very limited) a conference programme is being prepared covering maintenance work on a wide variety of plant in industry.

Likely sales boost — U.K. engineers in Russia

PRIVATE industry is not waiting for next May's British Trade Fair in Moscow to make the right contacts. Within a month of the British Institute of Directors reporting that Russia was willing to double her purchases of engineering equipment and that one of the main difficulties was getting in touch with the relevant factory chiefs, a dozen top British engineers are visiting factories from Moscow to the Urals and lecturing on their firms' products to groups of 50 to 60 Russian technicians. The organiser, Mr G. Wynne, claims this is the first privately organised trade and technical delegation to visit Russia since the war. Col E. C. MacKellar and Mr J. B. Bailey, of Westool. Mr C. E. B. Cooper, of John Thompson, and Mr N. Kirkwood, of Richardsons Westgarth, are in the party.

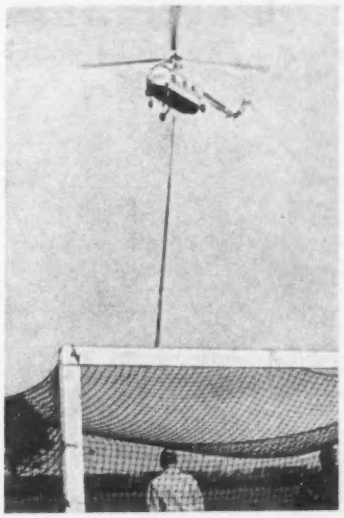
Electronic signal interlocking

SEMICONDUCTOR electronic equipment is to be developed for interlocking plant in railway signalling systems in a contract awarded to Mullard Equipment Ltd. by the British Transport Commission. Early next year the first equipment of this type will replace mechanical interlocking at the Henley-on-Thames signal box.

Basis of the new system is use of "logic" units for signal and point setting to give required train routing. Electronic units are of the plug-in type using Mullard transistors, semiconductor diodes and ferrite cores. They are designed for safe operation in ambient temperatures of between −20°C and +50°C. The units will be assembled so that they only permit connections to be made when signal and point settings are arranged to be safe in terms of train operation. The system operates with track circuits of the normal railway type.

New C.J.B. subsidiary

THE automatic control division of Constructors John Brown Ltd. has been formed into a wholly owned subsidiary. Directors of the new company, Automatic Control Engineering Ltd., are Messrs I. J. Crosthwaite, D.S.O. (chairman), H. D. Walker, R. Riley (general manager), H. H. Rosenbrock and M. P. Atkinson (chief engineer). Operations will be centred on Roxby Place, Seagrave Rd, Fulham, near the group's other works.



A 38 ft o.h. line pole being lifted into position by a helicopter during a demonstration to Mr A. N. Irens, chairman, S. Western EB, who is studying the suitability of helicopters for routine inspection of o.h. lines

Dishwashers Evaluated

SIX makes of dish-washing machines ranging in price from £89 5s to £180 14s 6d are discussed in the December issue of *Which?*, magazine of Consumers' Association Ltd. The conclusion is that although the washers leave some dishes clean and sparkling overall, they give results more patchy than with hand washing. They vary in their effectiveness with different types of dishes, being in general satisfactory with plates, cups and saucers, but not good with pans or cutlery. For this category, *Which?* awards no "best buy" but considers the Westinghouse model (the dearest), the Bulpitt Swanmaid and the Colston model to perform better than the other machines tested. Difference in price for these models is reckoned to reflect their variation in performance.

ROT STOPS IN REFRIGERATOR MARKET

REFRIGERATOR sales provided the bright spot in October. Stimulated by manufacturers' price cuts and aided by the mild autumn weather, they showed only a fraction of the usual seasonal decline. Only 564 fewer refrigerators were sold by area boards in October than in September, compared with a corresponding fall of 5,317 last year. Despite the imposition of hire-purchase restrictions in the meantime, October's sales were only 9·7% lower than in 1959. sales were only 9·7% lower than in the corresponding month of 1959.
from the pattern of the previous month. Washing machine sales totalled 9,178 against 9,422 in September, but were not quite so far behind the corresponding level of a year ago. Washboiler sales were steady in October, compared with September, but improved on September's lag of 23·5% behind sales for the corresponding month last year. The figures, supplied by the Electricity Council and covering all area boards in England and Wales, show clothes dryers sales for the first time.

Appliance sales by Area Boards	Sales in month ended 31 Oct., 1960		Sales in 12 months ended 31 Oct., 1960	
	Total	% change over corresponding period of 1959	Total	% change over previous 12 months
Cookers ...	31,320	0·0	339,910	+ 1·2
Water Heaters:				
Immersion	12,859	+10·3	189,575	− 0·5
Storage ...	5,636	+ 0·9	68,206	+14·9
Washboilers	4,981	−14·7	57,490	−17·9
Washing Machines ...	9,178	−17·4	121,592	−30·5
Refrigerators	7,560	− 9·7	140,430	−16·8
Clothes Dryers ...	6,661	−29·7	65,029	not avail.

RESTORATION AFTER FLOODS

QUICK recovery is reported from nearly all areas affected by the floods early last week. One of the new areas hit, South Wales, suffered considerable damage both to electricity supply installations and to manufacturing facilities. The Treforest Trading Estate, Glamorgan, for instance, was severely affected, total damage being estimated at nearly £6 million. Some factories were out of action for days. Simmonds Aerocessories Ltd. began limited production in mid-week, with all power resources being restored last Thursday, and many other factories were similarly affected. The transformer factory of South Wales Switchgear Ltd. was under water for a time and after several days spent on clearing up the mess, the plant was back in full production by the end of the week. Their Blackwood factory was unaffected, however.

To restore supplies in one part of its area the South Wales Electricity Board planned, erected and energised half a mile of 33 kV overhead line in 28 hr. Cables serving the Nantgarw Colliery were destroyed when the bridge over the Taff at Upper Boat was swept away, but with the new line the colliery was back on supply on the Monday night. Supplies to the Maritime Colliery and the gas works at Upper Boat were quickly restored by similar energising measures. Many of the Board's substations were flooded to depths of over 6 ft and all equipment had to be stripped from them and replaced with new equipment.

House-to-house operations in all the flooded localities were necessary to disconnect soaked installations in consumers' premises, preparatory to drying out before reconnection and, in most cases, supplies were available within 24 hr. Some installations were so badly soaked as to be dangerous, however.

In addition, in co-operation with the staff of several manufacturers of electrical appliances and members of the WVS, 12 laundry centres were set up in the worst-affected localities.

Upper Boat power station was shut down for a short time, as was that at Bath, where several substations in the low-lying parts of the town were swamped. But engineers of the South Western EB have become almost accustomed to quick remedial action this year and soon restored supplies when the floods passed. Further north, a coffer dam at the Rheidol hydro-electric scheme was swept away by a sudden rise in the river.

Management training

A SURVEY of management training schemes within industries of various sizes is being carried out by the British Institute of Management, and an interim report has just been published, price 17s 6d. This summarises the information so far obtained and contains the results of an investigation of the practices of over 30 undertakings.

PRIZE FOR JUVENILE "WIRING CONTRACTORS"

THE need for adequate wiring is being brought home to the younger generation at EDA's stand at the Schoolboys' Exhibition at Olympia from 27 Dec. to 7 Jan. A competition for the fastest and most judicious placing of sockets in Mum's All-electric Dreamhouse is the feature this year. Working in pairs—wireman and mate—in boiler suit and cap, the boys will race to place 38 sockets in the most convenient spots in two min. Perforated strip around the walls will enable them to plug in anywhere and, if the correct position is selected, a circuit will record their success on an indicator. The five-roomed house will be divided into three groups—hall and lounge, kitchen and bedroom and bathroom—so three pairs will be wiring at the same time. The boys, or girls, take home their plan and can invite their family to help them complete the plug layout for the rest of the house, the best entry winning a prize.

HOLME PIERREPONT INQUIRY

THE danger of serious smog around Nottingham if the proposed Holme Pierrepont power station was built, was stressed by Dr W. Dodd, Nottingham medical officer of health, at the resumed public inquiry into the scheme last Friday. If another power station was built, in addition to that at North Wilford, it would make the level of air pollution truly dangerous, he asserted. The provision of clean air was becoming as important as providing pure water, adequate sewerage and proper sanitation, but the proposals tended to make nonsense of any attempt to establish a clean-air zone, he went on. The 650 ft high chimneys would not remove the danger, only disperse it more widely.

Supporting evidence was also given by a Sneinton general practitioner and the inquiry was subequently adjourned until 23 Jan., 1961.

Decorative Lighting Dangers

MANY warnings are heard at this time of the year about the danger of Christmas trees or decorations catching fire. However, if the statistics given by the Home Secretary in a written Parliamentary answer last week are comprehensive, it seems that the danger may be less than sometimes supposed. In the period 24 Dec. to 31 Dec. last year, 14 fires attended by fire brigades in England and Wales involved Christmas decorations. Of these, only four were recorded as being caused by electrical faults.

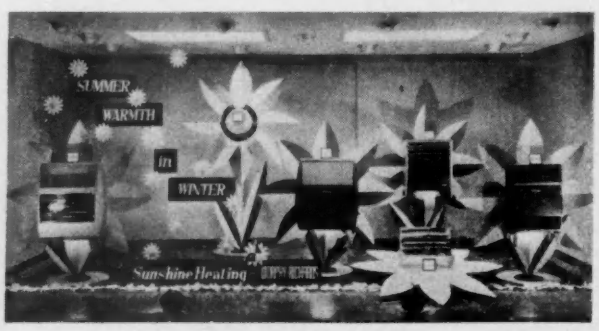
U.S. SHOWCASE FOR PICCADILLY

BOTH the US and Canada are warming up their export drives. The US Government will open a permanent trade centre near Piccadilly next spring to display consumer goods including household appliances. This will be the first Government-sponsored centre outside the US; London has been chosen because Britain is America's best customer after Canada. Mr Mueller, Secretary of Commerce, said in Washington last week that attractive display facilities, at no cost to exhibitors, would be backed by "aggressive" promotion on the part of joint Government-industry teams.

In Ottawa, businessmen from all over Canada are attending export conferences with trade commissioners, and interest in British and Australian markets is particularly heavy. Mr E. J. White, the Canadian Government timber specialist in London, believes there is a wide open market in Britain for domestic appliances such as electric clothes dryers, which are standard equipment in Canada.

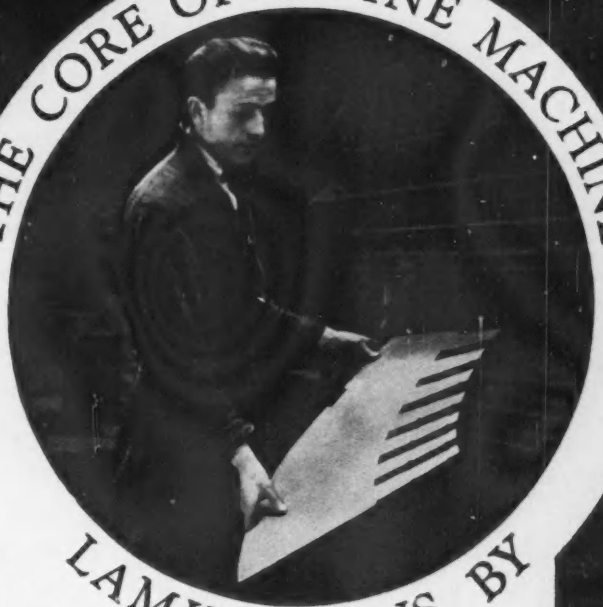
Part-exchange Allowances

A REVISED (1960) edition of their booklet on "Used Electrical Appliance Allowances" has been published by the National Electrical Contractors' Trading Association, price 5s. As before, this indicates appropriate part-exchange allowances on a wide variety of appliances up to five years old, but the figures have been revised in the light of suggestions made by NECTA members and additional appliances included.



This display won the £500 first prize for Coopers Ltd. of St. Ebbe's Corner, Oxford in the Morphy-Richards window dressing scheme. Second prize (£250) went to Spooner and Co. (display manager, Mr. V. J. Snelling), Royal Parade, Plymouth, and third prize (£100) to Northampton Co-op. Ten £50 prizes and 25 £10 prizes were also awarded

THE CORE OF A FINE MACHINE



LAMINATIONS BY

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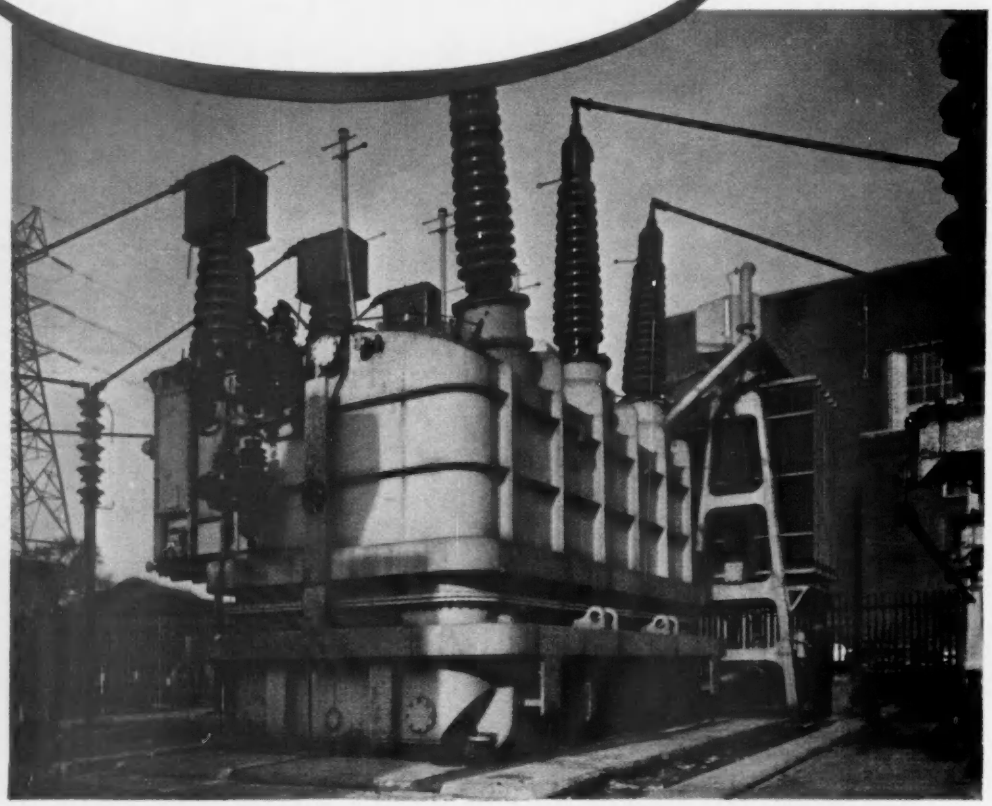
RTB

GRID linked to SUPER GRID



The first 180 MVA, 3 phase, 132/275 kV auto-transformer to be completed for the Central Electricity Generating Board.

Illustration shows the first of two of these transformers at the Skelton Grange Substation of the Yorkshire Division of the C.E.G.B.

The transformers, each fitted with resistor transition on-load tap changers, were manufactured at the AEI Rugby Transformer Works.

For further details write to AEI Transformer Division, Southmoor Road, Wythenshawe, Manchester 23 or your local AEI office.

AEI

Transformer Division
Manchester and Rugby
Associated Electrical Industries Limited

E/A002

Automation Conference booked for June

FIRST announcement by the reconstituted British Conference on Automation and Computation is that a symposium will be held at Harrogate from 27-30 June next under the general title—*Automation—Men and Money*. This event will be followed in the autumn by the first annual lecture, which will take the form of a review by an expert of the present position and probable future of automation in Britain.

BCAC are now setting up three panels to activate various aspects of the organisation's work. The panels, with their respective chairmen, are: Education and training, Prof G. D. S. MacLellan of Glasgow University; research and development, Mr J. F. Coales of Cambridge University; public relations, Mr W. C. F. Hessenberg, deputy-director of the British Iron & Steel Research Association.

These proposals were endorsed by representatives of the 32 member bodies at an inaugural dinner which the new chairman of BCAC, Sir Walter Puckey, gave at the Waldorf Hotel, London, last week.

RETAIL SALES SLACKEN

RECESSION in the motor and appliance industries has begun to affect retail trade. Provisional Board of Trade estimates indicate that retail sales fell by 2% between October and November. The rise in sales by clothing and footwear shops is believed to have slackened pace, and been insufficient to offset the fall in durable goods, such as furniture. However, expenditure on personal consumer goods is buoyant, with tobacco a record £301 million in the third quarter. Christmas trade in "cash" goods such as jewellery and gramophone records looks like being even better than last year, retailers say. After allowing for a slight price rise, overall sales in November were up to 2% higher than a year ago.

Sayings OF THE WEEK

"The UKAEA is rather like a modern King Midas. Everything it touches turns to plutonium." . . . PROFESSOR W. B. HALL, speaking at the Symposium on the Dounreay fast reactor.

"We have got into a condition of monotonous prosperity. I prefer it like that." . . . LORD BRABAZON OF TARA, deputy chairman, Electric and Musical Industries, at the annual general meeting.

"Scientific management is based on practices which include ensuring that men derive satisfaction as well as food from their daily work. Management in this country can be said to have secured its largest failure in this direction." . . . MR H. P. BARKER, chairman, British Institute of Management, speaking in Glasgow.

PRICES of cable metals and other materials

Figures quoted are the official prices ruling on Tuesday, December 13

	£ per ton	Weekly change £
COPPER, standard class A (settlement) ...	234½	−1
" (3 months)	230½	−1
LEAD, refined pig, 99·97% purity (cash)	66	−½
" (3 months)	67	−½
TIN, refined, min. 99·75% purity (settlement)	797½	−1½
" (3 months)	795½	−1½
ALUMINIUM, ingots 99·99·5% ...	186	—
" wire bars (4×4×54")	193½	—
BRASS Strip 63/37	207½	+3
SILVER (Troy oz)	79½d	—
ZINC, virgin, min. 98% purity (cash)	83½	−2½
" (3 months)	84	−2
RUBBER, per lb No. 1, RSS, spot	25½d	+¾d
c.i.f. basis, ports, Feb. ...	25½d	+½d
ARMOURING: Galv. Steel Wire (0·104 in.) ...	68	—
Mild Steel Tape (0·04 × 1½ in.)	53*	—
NICKEL (home)	600	—
MERCURY (76 lb flask)	70½	−½
AMERICAN PRICES: Copper, electrolytic (per lb) ...	30c	—
Lead, (New York)	12c	—

* *Tape Price, now an average, includes varnishing*

EASTERN REGION TRAIN TROUBLE

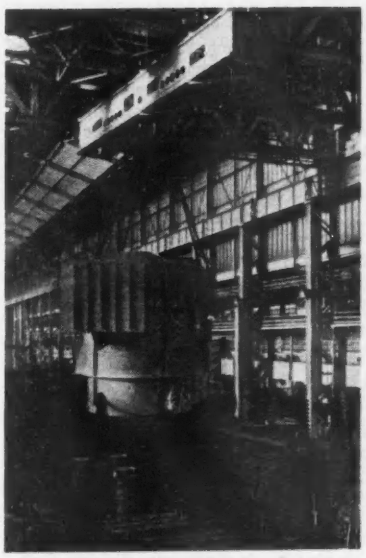
FAILURE of 25 kV stock on the newly electrified suburban train service out of Liverpool St station has been confirmed by British Railways as being due to breakdown of motor insulation and supply rectifiers under transient voltage conditions. Reasons for occurrence of such apparently extreme conditions is at present obscure.

The trouble affects both three- and four-car multiple stock, whose traction equipment is identical, and these are being withdrawn from service for the time being for thorough investigation by GEC, makers of the equipment.

This withdrawal has also brought considerable upset to time schedules, resulting in very strong criticism by passengers who had anticipated a much improved service with electrification.

Ultra links up with Miles

ULTRA Electronics Ltd. are to purchase a one-third share in Miles Electronics Ltd. The two companies, who are jointly developing the radar simulator for the Navy's new Blackburn Buccaneer aircraft, intend to widen the scope of their activities.



This 225 MVA three-phase generator transformer for Willington "B" power station—claimed to be the largest so far built for the CEGB—was recently shipped from the AEI Transformer Factory, Wythenshawe. Fully assembled, it is 34½ ft long, 19 ft wide and 25½ ft high, and weighs 256 ton

News in Brief

For the 1961 spring term the City of Portsmouth College of Technology has organised a programme of advanced short courses on microwave techniques and on transistors. The latter will be on Thursday evenings, and the former on Monday evenings. Fee for each course, 30s.

The Association of Consulting Engineers have published a new list of members.

Aerialite Ltd. are to hold a series of lectures on their floor-warming system at Polygon Hotel, Southampton, on 14 Feb.; Kimbells, Southsea on 15 Feb. and Hotel Metropole, Brighton, on 16 Feb., all at 7.30 p.m.

Head Wrightson Processes Ltd. have been awarded a contract worth nearly £500,000 for a flue gas washing plant, part of the extension to Bankside power station.

A £24,000 plan to install electric heating under the surface of a half-mile hill at Alfreton, Derbys, has been rejected by the Minister of Transport.

AEI are to transfer telephone cable manufacture from Woolwich to Dagenham.

Ministry of Education hopes to publish proposals for reorganisation of technical education in a White Paper to appear early in January. (Answer to a House of Commons question.)

As in 1958, the Council of Industrial Design will select light fittings and other goods for the Board of Trade's display at the second British Columbia International Trade Fair in Vancouver from 3 May to 13 May next.

Company Activities

JUST as on 27 Oct., when the Bank Rate was cut from 6% to 5½%, so there was no surprise in the City when it was again reduced last week from 5½% to 5%. Logically, there has been only one cut but the operation, for psychological reasons, has been spread over six weeks. It implies no ease in the "squeeze"—a straight 1% reduction in October might have been so interpreted—and is widely recognised as all part of our gesture to further iron out interest rate differentials between the European economies and that of the United States, embarrassed by the continuing drain on its gold holding and its deteriorating balance of payments. So stock markets in London which theoretically might have been expected to firm up with a fall in the prime money rate did precisely the opposite. Economic prospects at home, thickly surrounded with gloom so long as our export/import position tends to worsen rather than improve, are exerting a far greater down-pull on market prices than the upward tendency which would be the normal response of capital values to a chop in the price of money.

In fact, after the Bank Rate announcement the "short" end of the Gilt-Edged Market did go a little harder, à la textbook, but the mighty War Loan dropped to a new 1960 "low" of £59¾, typical of the weakness displayed by the undated stocks, while the *Financial Times* industrial ordinary index toppled a further 1·4 points to a then new low of 294·6 for the year. Later, it dropped yet again to 293·4.

As will be seen from my table, leading electrical shares for the most part were inclined to soften rather than improve, with AEI at a new "low" for the year. News of short-time working at one of its "Hotpoint" refrigerator factories, of course, contributed to this result and both English Electric and GEC were easier in sympathy.

On the brighter side, Plessey scored a gain of 3d over the week on the full report from chairman Mr A. G. Clark, who told us that the group's profit in the first 4 months of their current year (July-October) shows no material change from that of the corresponding period.

At the yearly meeting of Electric and Musical Industries, deputy-chairman Lord Brabazon told shareholders that the company had got itself into a condition of "monotonous prosperity." Earlier, chairman Sir Joseph Lockwood had gone better than Plessey when he made known that EMI's group turnover, which now includes Morphy-Richards and Ardente, had risen 5% over 1959/60 in the first four months of its current year, i.e., from July to October inclusive.

Ultra Electric (Holdings) might have been expected to have moved higher rather than lower on being the first British manufacturer to launch a "19-inch" t.v. set, but the fall from 13s 3d to 11s 7½d anticipates similar news from others.—*From our City Correspondent.*

Electrical Share Movement Either Side of Bank Rate Change
(Middle prices at close of days' business)

SHARE	5 Dec.	7 Dec.	8 Dec. Bank Rate cut from 5½% to 5%	9 Dec.
A.E.I. £1 ...	40/9	40/-	39/9	39/6
Berry's Elect. Magicoal 5/- ...	50/-	50/-	48/9	48/9
B.I.C.C. £1 ...	49/6	48/6	48/6	48/1½
E. K. Cole 5/- ...	19/7½	19/4½	19/-	18/7½
Crompton, P. 5/-	11/3	11/1½	11/1½	11/1½
Decca Rec. 10/-	49/6	49/6	49/6	49/6
E.M.I. 10/- ...	41/9	42/-	42/3	42/-
Ell't Auto. 5/- ...	24/6	24/1½	23/3	22/10½
English Elec. £1	32/6	31/7½	31/-	30/9
G.E.C. £1 ...	30/6	29/10½	30/-	30/-
Hoover 5/- "A"	41/9	40/3	40/3	40/-
Parsons, C. A. £1	46/-	45/6	45/-	45/-
Plessey 10/- ...	43/9	43/-	44/3	44/-
Thorn Elec. 5/-...	45/6	45/6	45/6	45/7½
Ultra Elec. 5/- ...	13/3	13/-	12/9	11/7½

Berry Trust

This concern, whose investments include a substantial holding in Berry's Electric Magicoal, is paying an interim dividend of 10% for the year to 31 Aug., 1961, and a higher profit and total payment than that foreshadowed when the company was made public last September is now forecast. Estimated profit should be not less than £41,000—against £34,000 originally expected—and if this is realised, total distribution will be 33⅓%, compared with the previous indication of 28%.

Brook Motors Ltd.

Trading profit for the year to 30 Sept. last increased to £681,917 from the previous year's total of £572,436. A final of 20% makes the total distribution again 25% on capital as increased by a one-for-six scrip issue.

Dawes Radio Group

A quotation is being sought in London and Manchester for the capital of this group, which has 36 shops in the Manchester area, operating rental and retail sale of TV and radio sets and the larger domestic appliances. The capital consists of 125,000 7% £1 Redeemable Cumulative Preference shares and 720,000 Ordinary 5s shares. Profits for 1959-60, subject only to tax, were £106,000 and for the current period ending 30 June next the directors expect profits to be not less than £111,000, with a forecast of a 20% dividend.

Engineering and Lighting Equipment Co.

Along with a change of name to Eleco Ltd. the directors propose to obtain an up-to-date valuation of the plant and buildings owned by the company and its subsidiaries. The financial year is also to end on 30 June in future and, accordingly, the current period will be extended to 15 months. In the circumstances, the directors are to consider payment of a further interim dividend for the current period about May, 1961.

Ericsson Telephones Ltd.

Of the 1,600,096 Ordinary 5s shares offered at 18s each, acceptances were received in respect of 1,565,294 shares.

Kalgoorlie Electric Power and Lighting Corpn.

In view of the necessity to conserve resources with a view to modernising plant, £50,000 has been placed in a plant modernisation reserve. This question of modernisation is an important one and involves agreement with the major consumers on the future supply of current. Negotiations with the latter have already started both on re-equipment of the station and the problem of financing that work.

Oliver Pell Control Ltd.

The reduction of trading profit to £10,219, from the previous year's total of £37,908, was largely attributable to heavy expenditure incurred in the continued expansion of the company's production facilities, the directors point out. After depreciation and other charges, there was a loss of £14,239 for the year ended 31 March last, but the dividend is again 6%.

Plessey Co. Ltd.

While some of the industries this company serves have not been having an easy time this year, others are busy and the company's profits for the first four months show no material change from those of the corresponding period of last year, Mr A. G. Clark, the chairman, reports. The directors consider that the prospects for the further development and extension of the business are good. Cash and investments at the end of June last stood at £6,649,157 and the new rights issue will provide an additional £9,533,000, which is to be employed in new plant and buildings to produce new products, purchase other businesses and establish additional overseas companies.

Dividends Declared

Aiton and Co. Interim 4% (*same*).

Electric and General Investment. Interim 3% (*same*), but on increased capital.

Garrard Engrg. and Manfg. Interim 4% (*same*).

Hawker Siddeley Group. Second interim 5%.

Hick Hargreaves and Co. Interim 5% (4%).

Lisbon Electric Tramways Interim 2% tax free (*same*).

Telephone Rentals. Interim 5% (*same*).

COMMERCIAL INFORMATION

Contracts Open at Home . . .

Dates given are the final for receipt of tenders unless otherwise stated.

15 Dec.—Stockport T.C. Electrical installation in new dormitory wing and extension at "Reinbek," Aged Person's Home, Bramhall La.—See 1 Dec. issue.

16 Dec.—Braintree and Bocking U.D.C. Wiring, by contractors on N.I.C.E.I.C. roll, in 22 existing houses. Engineer and Surveyor, Town Hall. Deposit £1 1s.

16 Dec.—Bristol T.C. (2) Electrical installation, by contractors on N.I.C.E.I.C. roll, in Assembly Hall extension, new kitchen and staff accommodation at Baptist Mills Secondary School. Applications to City Architect, Council Hse, by above date. Alternative tenders for fixed price and fluctuations required.

16 Dec.—Derby B.C. Supply of lamps, batteries, cables and accessories for year to 28 Feb., 1962. Borough Engineer and Surveyor: M. L. Francis, Council Hse.

16 Dec.—Dunbarton C.C. Erection and wiring only of fluorescent street and footpath lighting comprising: 35 points Seafar—5 area; and 88 points Maurhead—4 area at Cumbernauld.—See 8 Dec. issue.

16 Dec.—Harrogate and Ripon Hospital Committee. Applications invited for inclusion in approved list for electrical, radio and television maintenance. Applications to Group Secretary: F. M. Haughton, Hereford Lodge, Cornwall Rd, Harrogate, by above date.

16 Dec.—Maidstone B.C. Electrical installation in conversion of 13 London Rd into an old people's hostel.—See 1 Dec. issue.

16 Dec.—Montgomeryshire C.C. Electrical installations in: Bettws School and canteen; Llanbrynmair School, canteen and head teacher's house; Bont School, canteen and head teacher's house. Director of Education: J. A. Davies, Education Offices, Newtown.

16 Dec.—Rochester C.C. Electrical installations on fixed-price basis in 36 houses, Cliffe Rd estate.—See 8 Dec. issue.

16 Dec.—Sunderland B.C. Electrical installation in Maternity and Child Welfare Clinic, Hylton Castle estate.—Advertised 24 Nov. issue.

16 Dec.—Wandsworth B.C. (h) Supply of lamps; and (i) electrical works for year from 1 April, 1961.—See 24 Nov. issue.

17 Dec.—Birkenhead B.C. Supply of lamps for year.—See 1 Dec. issue.

17 Dec.—Inverkeithing B.C. Electrical work in erection of ten dwellings of four and five apartments at Preston Cres. Applications to Town Clerk, R. Mitchell, Burgh Chmbrs, by above date.

19 Dec.—Fylde Water Board. Electrical installation in Hodder Wks, Slaidburn. Board Engineer, Sefton St, Blackpool.

19 Dec.—N.I. Housing Trust. Electrical installations in 62 dwellings at Greenisland No. 2. Trust Offices, 12 Hope St, Belfast.

19 Dec.—Nottingham T.C. Supply of (Item 1) lamps and accessories.—See 1 Dec. issue.

19 Dec.—West Lothian C.C. Supply and erection of 31 200 W sodium lanterns on 35 ft steel columns with 10 ft 6 in. outreach for A8/A89 Starlaw and A8/A899 Broxburn junctions lighting.—See 24 Nov. issue.

20 Dec.—Southampton B.C. (a) Electrical installation renewal at Millbrook Secondary Boys' School and (b) electrical installation in new Glen Eyre Secondary Boys' School.—See 1 Dec. issue.

21 Dec.—Fareham U.D.C. Supply and installation of sewage pump, complete with motor and control gear for Peel Common.—See 24 Nov. issue.

22 Dec.—Ealing B.C. Electrical installation renewal at St. Ann's Secondary Girls' School, Springfield Rd.—Advertised 1 Dec. issue.

23 Dec.—Brentwood U.D.C. Supply of (Tender 22) lamps for year. Engineer and Surveyor, Council Offices.

23 Dec.—Eastleigh B.C. Supply of (Item 10) street lighting lamps for year from 1 April, 1961.—See 8 Dec. issue.

28 Dec.—Haltemprice U.D.C. Supply of (Schedule 18) street lighting lamps and tubes. Engineer and Surveyor, Anlaby Hse, Anlaby.

28 Dec.—Prestwich B.C. Supply and erection, on fixed-price basis, of 26 reinforced concrete columns with 24 fluorescent and two sodium lamps/gear along Rectory Rd and 27 concrete columns with sodium lighting at King's Rd, plus removal of 31 existing units. Borough Engineer, Town Hall.

30 Dec.—Denby Dale U.D.C. Supply, erection and wiring of 225 25 ft Stanton concrete columns together with 140 W sodium lamps/lanterns/gear along A636 Wakefield Rd and A635 Barnsley Rd.—See 8 Dec. issue.

30 Dec.—Monaghan C.C. (b) Erection and installation of two pumping sets to deliver 28 g.p.m. at a 106 ft head for Rockcarry scheme. Supply and/or erection of two 42 g.p.m. pumps at a 128 ft head for Newbliss.—See 1 Dec. issue.

31 Dec.—Llanfyllin R.D.C. Electrical installation in new offices.—See 8 Dec. issue.

2 Jan.—Droitwich B.C. Supply and erection of 52 street lamps, together with lanterns/gear/wiring. Borough Engineer and Surveyor, Town Hall. Deposit £2 2s.—Advertised in this issue.

2 Jan.—Romford B.C. Supply of 200 W sodium lamps/lanterns/gear/brackets for conversion of 69 existing units. Borough Engineer and Surveyor, Town Hall. Deposit £2 2s.

2 Jan.—Romford B.C. Tender M26. Supply of lamps for year. Borough Engineer, Town Hall.

3 Jan.—Manchester C.C. Provision of road and car park mercury vapour lighting at Manchester Airport. City Surveyor, Town Hall.

3 Jan.—Radcliffe B.C. Supply and installation of 43 140 W sodium lamps on 25 ft columns and brackets, plus removal of 28 existing units along A667, Ringley Rd.—See 1 Dec. issue.

4 Jan.—Manchester C.C. Electrical services installation in Central Technical College, Manchester 15. City Architect, P.O. Box 488, Town Hall.

5 Jan.—Belfast C.C. (a) Electrical installation in Fane St Secondary School.—See 8 Dec. issue.

6 Jan.—Belfast C.C. (a) Supply of condenser tubes and (b) supply and erection of 25 kW germanium diode rectifier sets (Specifications W184 and 5, respectively).—See 8 Dec. issue.

6 Jan.—Camberwell B.C. Supply of (Item k) lamps and (Item s) cables, conduit and fittings. Borough Engineer and Surveyor, Town Hall, S.E.5.

6 Jan.—Kilkeel. Electrical installation in Holy Cross Primary School. Documents from consulting engineer, C. P. McNally, 143 Royal Ave, Belfast. Deposit £3 3s.

6 Jan.—Wanstead and Woodford B.C. Supply of (Item 13) for year.—See 8 Dec. issue.

6 Jan.—Wood Green B.C. Supply of (Item 17) lamps for one, two or three years. Borough Engineer and Surveyor, Town Hall, N.22.

7 Jan.—Baldock U.D.C. Supply and erection of 11 25 ft concrete columns with 140 W sodium lighting. Engineer and Surveyor, Council Offices. Deposit £2 2s.

7 Jan.—Bath C.C. Supply of (Item 40) l.v. cables; (41) discharge lamps; (42) tungsten lamps and fittings; (43) steel and concrete columns; (44) street lighting lanterns; (45) control gear and capacitors; (46) time switches, for year.—See 8 Dec. issue.

7 Jan.—Dagenham B.C. Supply of (Item 31) lamps for year. Borough Engineer and Surveyor.

9 Jan.—Swansea B.C. Two disintegrator sets, pipes, valves, control gear, switches, switchboard, etc., for Limeslade Sewerage Scheme. Borough Engineer and Surveyor, R. D. Moody, The Guildhall.

10 Jan.—Dunblane B.C. Supply and erection of seven Group "A" concrete columns/lanterns/auxiliary equipment, plus the resiting of six columns along A9.—See 10 Nov. issue.

11 Jan.—Tonbridge R.D.C. Wiring, by registered contractors, of Council Offices and proposed extension 48 Pembury Rd. Engineer and Surveyor, 48 Pembury Rd.

16 Jan.—Bermondsey B.C. Supply of lamps for year.—See 8 Dec.

17 Jan.—Newcastle upon Tyne C.C. Supply and installation of two automatic passenger lifts in each of two 15-storey blocks of flats at Longbenton estate.—See 8 Dec. issue.

28 Jan.—Camborne-Redruth U.D.C. Supply of (Item 24) electrical equipment and fittings for year.—See 8 Dec. issue.

1 Feb.—Oxford T.C. Supply and erection of

Your Queries Answered

Readers are invited to make use of our free enquiry department which possesses wide resources, including an index of trade information with over 100,000 entries

A Selection from the 109 queries answered this week

"Fairline" washing machines—makers of? Y.E.B.—Fairline Electrical Products Ltd., High Bank Mill, Godley, Hyde, Cheshire.

"Salmic" toaster elements—address for spares? L.E.B.—Metway Electrical Industries Ltd., Kemp Town, Brighton 7, Sussex.

"Everay" H.F. violet ray equipment—address for? L. and C.—Watson and Sons (Electro-Medical) Ltd., East La, North Wembley, Middx.

"Q-Max" chassis cutters—makers of? W.E.S.—"Q-Max" (Electronics) Ltd., Napier Hse, High Holborn, W.C.1.

"Grillfix" infra-red grillers—agents for? M.A.N.W.E.B.—Fairfax Engineering Ltd., 1 Regency Parade, Finchley Rd, N.W.3.

"Toastmaster" toasters—agents for? B.E.—Frank V. Magrini Ltd., 24 Royal College St, N.W.1.

"Infralux" heat-light fitting—makers of? T.E.—Selex Electric (Kirkby) Ltd., Yardley Rd, Industrial Estate, Kirkby, Lancs.

"Nura" lamps—makers of? P.E.—Omega Lampworks Ltd., Albany Wks, Burlington Rd, New Malden, Surrey.

Mlag, Braunschweig, Germany, makers of grinding machines—agents for? E.T.—D.M.M. Machinery Ltd., 60 Buckingham Palace Rd, S.W.1.

two high-lift 3,500 g.p.m. and two low-lift 3,850 g.p.m. pumps complete with motors, switchgear and cabling.—See 10 Nov. issue.

No date stated—Loch Lee Water Board. Supply and installation of switchboards, wiring, lighting and heating installations for first phase Loch Lee scheme. Documents from engineers: Crough and Hogg, 18 Woodside Cres, Glasgow C.3. Deposit £5.

No date stated—North of Scotland H.E.B. Supply and erection of 132 kV steel tower double circuit spur line to Burghmuir.—Advertised 8 Dec. issue.

. . . and Overseas

*Details of items marked * may be obtained on application to the Board of Trade, Lacon Hse, Theobalds Rd, W.C.1, quoting reference.*

20 Dec.—Argentina. 10,000 s.-ph. and 500 three-phase meters. Direccion Energia, Ministerio de Obras Publicas, Calle 6, No. 636, La Plata, Buenos Aires. B.o.T. (ESB/32323/60).*

20 Dec.—Ceylon. 33 kV "D" fuse brackets for pole mounting. Chairman, Tender Board, Dept. of Government Electrical Undertakings, P.O. Box 540, Colombo. B.o.T. (ESB/32417/60).*

20, 21 and 22 Dec.—India. L.T. switchgear, transformers and h.t. switchgear. Purchase Officer, Trombay Establishment, Mohatta Bldg, Palton Rd, Bombay. B.o.T. (ESB/31865/6/7/60).*

21 Dec.—America. (1) Ten disconnecting switches, horn gap switch and three interrupter switches; (2) Four 230 kV 1,200 A disconnecting switches. Dept. of the Interior, Bureau of Reclamation, C. S. Shisler, Bldg 53, Denver Federal Center. B.o.T. (ESB/31340 and 31475/60).*

22 Dec.—Burma. Electronic equipment, 13 items. Director-General, Union of Burma Purchase Board, St. John's Rd, Rangoon. B.o.T. (ESB/31892/60).*

23 Dec.—Netherlands. Generators for four Tacan Stations. N.A.T.O. Infrastructure contract ICB.99. Directeur Gebouwen, Werken en Terreinen, Kalvermarkt 28, The Hague. B.o.T. (G.D.5758/14).

23 Dec.—Portuguese East Africa. Power distribution network for Vila Cabral. Public Works Dept., Lourenço Marques. B.o.T. (ESB/31747/60).*

28 Dec.—Kuwait. 500 fluorescent fittings and 1,900 plastics shades. Dept. of Electricity, Water and Gas. B.o.T. (ESB/21815/60).*

30 Dec.—Burma. Lighting fittings and accessories, 28 items. Clement Mills, Ind. Development Corpn., Thayetmyo. B.o.T. (ESB/31904/60).*

30 Dec.—India. 100 tons h.d. bare solid copper-conductors from 1 to 10 s.w.g. Director-General of Supplies and Disposals, Shahjahan Rd, New Delhi. B.o.T. (ESB/31843/60.)*

4 Jan.—Kuwait. 1,000 mercury vapour lanterns complete with control gear, steel poles/brackets and street lighting cutouts. Dept. of Electricity, Water and Gas. B.o.T. (ESB/31829/60).*

10 Jan.—Ceylon. 2, 5 and 10 kW spotlights, bulbs, cables, etc. Chairman, Tender Board, Ministry of Defence and External Affairs. B.o.T. (ESB/31819/60).*

15 Jan.—Kuwait. 70,000 yd 11 kV, 0·25 sq in. 3-core p.i.l.c. cable and junction boxes. Dept. of Electricity, Water and Gas. B.o.T. (ESB/31812/60).*

16 Jan.—Ghana. Tender: ELEC. 4023/1, 61,000 yd l.t. underground cable. Tender: ELEC. 4024/1, 29,000 yd h.t. underground cable. Secretary, Ghana Supply Commission, P.O. Box M.35, Accra. Documents fee: £G1.—Advertised in this issue.

18 Jan.—Ceylon. Six and 12 V batteries. Crown Agents, 4 Millbank, London S.W.1. B.o.T. (ESB/31468/60).*

19 Jan.—India. 21 outdoor transformers and equipment for electrical repair shop. Director-General of Supplies and Disposals, Shahjahan Rd, New Delhi. B.o.T. (ESB/29420/60).*

24 Jan.—India. Electrical testing equipment for Amarkantak thermal station scheme. Superintending Engineer (Projects), Madhya Pradesh Electricity Board, Jabalpur. B.o.T. (ESB/31864/60).*

26 Dec.—India. 95,800 yd 660 V aerial cable. Chief Engineer (South), Stores Purchase Section, The Mall, Patiala. B.o.T. (ESB/31905/60).*

TRADE NOTES

New Depot. The General Electric Co. has opened a new depot at Crawley, which replaces the old premises at Brighton. Ample parking space is provided. Manager at Crawley is Mr G. Knight, formerly deputy manager at Brighton.

Expansion. Birmingham Battery and Metal Co. Ltd. have purchased the Redditch factory of Eccles (Birmingham) Ltd., whose main premises are at Stirchley.

Service. Magnavox have this week opened a new Dealer Service Dept. at 20-22 Corsica St, Highbury, N.5 (telephone: Canonbury 5041), where Mr F. W. Stanhope is in charge.

Marketing. From 1 Jan., 1961, marketing arrangements for the "Reguplug" will be taken over by the Distribution Equipment Sales Dept., A.E.I. Cable Division, 155 Charing Cross Rd, W.C.2.

CONTRACTS PLACED

Durham C.C. Electrical installations in: Bearpark County School, G. Tregoning, £773; new village hall, Middleton-in-Teesdale, N. of England Eng. and Electrical Co. Ltd., £705. Recommended.

Heston and Isleworth B.C. Installation renewals and additional power points in 92 houses, Worple estate, Hughes Electrical Ltd., £1,669. Recommended.

Islington B.C. Supply and erection of main road columns/lanterns, Harland and Wolff Ltd., £22,596. Recommended.

Kirkburton U.D.C. Supply and installation of 88 200 W sodium lighting on 35 ft columns along Penistone Rd, Anderson and Heeley Ltd.

Liverpool C.C. Supply of distribution board for South Sewage Disposal Wks, English Electric Ltd., £898 13s; supply of lamps, Downes and Davies Ltd., Philips Electrical Ltd. and Atlas Lighting Ltd. Recommended.

Newcastle upon Tyne Hospital Board. Electrical work in: Winterton Hospital, N. of England Eng. and Electrical Co. Ltd., £2,537; new pathological laboratory, Sunderland Royal Infirmary, Selborne Eng. Co. Ltd., £1,093. Staff location systems at Newcastle General and Dryburn Hospital, Multitone Electrical Co. Ltd., £4,635 and £2,369 10s, respectively.

Northumberland C.C. Stage lighting installation, Morpeth Newminster Secondary School and rewiring Pegswood central kitchen, J. and A. Oliver Ltd., £320 9s and £307, respectively. Electrical installation, Stakeford Primary School, Mood and Son, £824. Electrical installation renewal, Berwick Grammar School, S. of Scotland E.B., £1,564. Electrical installation, Birtley C.E. Controlled School, J. Robinson (Electrical) Ltd., £507. Recommended.

Peterborough C.C. Electrical installations in 98 dwellings, Bluebell estate, M. F Hansen, £2,297 10s.

Wessex Hospital Board. Electrical work: Firs Hospital, Bournemouth, conversions, E. W. Forster and Co., £5,308: St. James Hospital, Portsmouth, G. E. Taylor (London) Ltd., £1,983; Salisbury General Infirmary, R. F. Webb Ltd., £858; Lord Mayor Treloar Hospital alterations, etc., R. F. Webb Ltd., £2,325. Recommended.

NEW COMPANIES

Extracted from the Register issued by Jordan and Sons Ltd., 116 Chancery La, W.C.2.

Evolux Ltd., 15 High St, Langley, Oldbury, Birmingham. Manufacturers of and dealers in electrical and other equipment, etc. Nom. cap.: £100. Dirs.: Philip W. Peters and Evelyn J. Peters.

F. and B. Electrics (Contracts) Ltd., 215 High St, Hounslow, Middx. Nom. cap.: £100. Dirs.: Edwd. A. Brimfield and Mrs J. L. Brimfield.

M and A (Cambridge) Ltd. Electricians, etc. Nom. cap.: £1,000. Dirs.: Dennis F. Morgan, Red Roofs, Histon, Cambridge; and Maurice E. Allgood, 18 Redfern Close, Cambridge.

Mactric Electric Ltd., 43 Raydon St, N.19. Electrical engineers, etc. Nom. cap.: £100. Dirs.: Henry J. Knights and James McAneny.

Power Electrical (London) Ltd., 101 High St, Orpington, Kent. Nom. cap.: £1,000. Dirs.: Frank E. Baker and Paul Trummel.

Queensway Electrical Ltd., 97 Queensway, W.2. Manufacturers of and dealers in washing machines, refrigerators, etc. Nom. cap.: £100. Dir.: Harold Freedman.

Shawford Control Gear Co. Ltd., Midland Terr, Victoria Rd, N.W.10. Nom. cap.: £2,500. Dirs.: Charles F. Ford, Peter L. Norton, Eric C. L. Basan and Donald C. Ambrose.

Simon-Carves (Japan) Ltd., Bird Hall La, Cheadle Heath, Stockport. To carry on business of mechanical, chemical, civil, electrical, constructional or nuclear engineers, etc. Nom. cap.: £10,000. Dirs.: David T. Barrit, Leopold Brook, Hubert Clarke, Norman Hinton and John P. V. Woollam.

A. E. Southey and Co. Ltd., 22 The Broadway, N.14. Electricians, etc. Nom. cap.: £12,000. Dirs.: Albert E. Southey, Albert R. Southey, Mrs Daisy G. Southey and Gertrude B. Southey.

Wilson and Harper Ltd., 29 Cross St, Macclesfield. To take over business of electrical contractors carried on at Macclesfield by Derrick Wilson and Gordon H. Harper, etc. Nom. cap.: £5,000. Dirs.: Derrick Wilson, Gordon H. Harper, Mrs Norma C. Wilson and Mrs Violet M. Harper.

TRADE MARKS

This information is extracted from the Official Journal by permission of the Controller.

Auto-Home. B789,817. Class 8. Shaving instruments. Sperry Rand Corpn., 100 West Tenth St, Wilmington, Delaware, U.S.A.

AT in design. B800,480. Class 9. Semiconductor devices. Associated Transistors Ltd., Stonefield Way, Victoria Rd, Ruislip.

Amplilite. 802,365. Class 9. Telephonic and radio telephonic apparatus. Amplivox Ltd., Beresford Ave, Wembley.

G. Matic. 795,756. Class 7. Washing machines, etc. Bylock Electric Ltd., 109 South St, Enfield.

Powramp. 805,951. Class 9. Apparatus, etc. Plessey Co. Ltd., 1 Broad St Pl, E.C.2.

Rayglo. 808,352. Class 10. Blankets. Cupal Ltd., Phoenix Mill, King St Bridge, Blackburn, Lancs.

Sunray. 801,992. Class 11. Electrical convector heaters, etc. L. G. Hawkins and Co. Ltd., 30-35 Drury La, W.C.2.

Tootal. 796,145. Class 9. Apparatus, etc. Thermo Plastics Ltd., Luton Rd Wks, Dunstable.

Transcap. 808,637. Class 9. Condensers. Erie Resistor Ltd., Millora Wks, Beevor Rd, South Denes, Gt. Yarmouth.

BUSINESS PROSPECTS

Basingstoke. Percy Bilton, 54 Uxbridge Rd, W.5, plan factory and offices covering 20,480 sq ft off Winchester Rd.—Wilkinson Sword Ltd., Sword Wks, Southfield Rd, W.4, plan Houndsmills estate factory.—£2,700 street lighting scheme, South Hand housing estate, planned.

Bebington B.C. Tender: Four-storey block of ten shops with flats and maisonnettes, Clifton Ave, Mill Park estate. Engineer.

Belfast. Young and Mackenzie, 2 Wellington Pl, Belfast, architects for new halls of residence at Queen's University.

Billericay (Essex). N.E. Metropolitan Hospital Board, 40 Eastbourne Terr, W.2, plan £24,533 conversion at St. Andrews Hospital for nurses' accommodation.

Birkenhead. Marcus Leaver and Co., 36 Bruton St, W.1, plan supermarket and three shops in Central Shopping Area.—Robert Grinling, 2 Halkin St, Hyde Park Corner, S.W.1, architect for three-storey office building at Price St and Market St for C. L. Gray Properties.

Birmingham. Westhill Training College, Selly Oak, Birmingham 29, plan £100,000 college extensions at Bristol Rd.

Blackpool. £2,000 lighting scheme, Talbot Rd, planned between Larkhill St and Gorton St; £24,800 improved lighting scheme planned for Gynn Sq/Morbeck section of promenade.

Bolton. Bromilow and Edwards, Foundry St, plan accommodation of all their production on adjacent ten-acre site.

Bradford. Arndale Property Trust, Howard Hse, Bank St, plan rebuilding of The Swan Arcade, Market St.

Brentford. D. Plaskett Marshall and Ptnrs, 59 Gordon Sq, W.C.1, architects for Barnaby Gardens youth hostel.

Bridgend U.D.C. Tender: Three blocks aged persons' flats, each of eight-, one- or two-bedroom flats on fixed-price basis, Black La North housing site. Surveyor.

Brighton. Morgan and Carn, 12 Grand Ave, Hove, Sussex, architects for Jaycee Furniture's Woodingdean factory and Eagle Star Insurance Co.'s offices.

Bristol. T.C. to approve scheme for £100,000 scheme for handicapped people at Gainsborough Sq, Lockleaze.

Bromley. Education Committee Tender: Two new laboratories and canteen extensions, Bromley County Grammar School for Boys. Engineer.

Cheltenham. Diocesan Trustees of Clifton, Bristol, plan R.C. secondary school, Arle Rd.

Chester. Liverpool Hospital Board plan £76,000 Moston Military Hospital adaptation to provide accommodation for 330 patients.

Chichester. Sir Hugh Casson, 33 Thurloe Pl, S.W.7, architect for rebuilding 1 and 2 South St.

Chislehurst and Sidcup. U.D.C. plans £31,600 street lighting improvements on 40 roads.

Coventry. Associated British Cinemas, 30 Golden Sq, W.1, plan cinema and associated development at junction Hill St/Corporation St to replace Empire Cinema.—Sketchley, 3 The Precinct, plan dry cleaning works, flats and shops of Hales St Opera Hse site.

Cumberland C.C. Tender: Stage 3, Thursby Primary School. Acting County Architect: H. R. Clark, 15 Portland Sq, Carlisle.

Dagenham. Southern United Telephone Cables, Chequers La, plan cable drum shop and manufacturing building.

Doncaster. B.C. plan £23,240 Stage 4 of street lighting conversion scheme.

Dronfield U.D.C. Tender: 48 "Holmeville" type houses. Surveyor.

Dunfermline. Monotype Corporation, Salfords, Surrey, plan factory to employ 200-300.

Durham. Education Committee plans electrical rewiring of West Stanley Front St County School at £2,000 and Birtley George St County and Modern, £2,200.

Easington. R.D.C. plans £7,528 improvement of electrical facilities in over 2,000 pre-war houses.

Eastbourne. £5,458 street lighting scheme planned for Victoria Drive/Green St/Willingdon Rd.

Edinburgh. Works Committee plan £125,000 conversion of street lamps to electricity; £50,000 improvement of lighting in streets already electrically lit and £23,000 street lighting for new housing schemes.

Felling. Newcastle Hospital Board, Benfield Rd, Newcastle, plan alterations at Windy Nook Hospital to provide offices.

Flint B.C. Tender: 39 bungalows, Highfield, Bagillt. Engineer.

Gateshead. Gateshead and District Co-op. Society plan conversion of Jackson St masonic hall into shops. C.W.S. Architect's Dept., 90 Westmorland Rd, Newcastle.—E. M. Lawson, Barras Bldgs, Barras Bridge, Newcastle, architect for Hardy and Co.'s central offices on site of disused Shipcote Cinema, Low Fell.

Grays, Essex. N.E. Metropolitan Hospital Board, 40 Eastbourne Terr, W.1, plan £335,000 Ossett Hospital extensions.

Grimsby. D. Byford and Co., Abbey La, Leicester, plan Immingham factory.

Hartlepool. Newcastle Hospital Board, Benfield Rd, Newcastle, plan out-patients' dept. offices at Hartlepool Hospital.

Hastings. Hastings Grammar School, off St. Helens Rd, near Alexander Park estate, planned to cost £215,000.

Hatfield R.D.C. Tender: 30 dwellings, School La, Essendon. W. J. Davis, 82 Gt. North Rd, Engineer and Surveyor.

Heston. Middlesex C.C. plan £115,000 Vicarage Farm Rd home for the aged. Architect: H. J. Whitfield Lewis, Queen Anne's Gate Bldgs, Dartmouth St, S.W.1.

Irvine. Elliott, Cox and Ptnrs, 172 Buckingham Palace Rd, S.W.1, architects for Skefko Ball Bearing Co.'s factory.

Kettering. Oxford Hospital Board, Banbury Rd, Oxford, plan £600,000 extensions to General Hospital.

Kingswood, Bristol. Rank Organisation, 11 Belgrave Rd, S.W.1, plan £200,000 conversion of Odeon Cinema into bowling alley.

Leeds. Gillinson and Barnett, 8 Queen's Sq, Leeds 2, architects for Grant Leeman and Co.'s flatted factory, warehouse and offices on North St area site.

London. Sumner and Derwent, 151a Queensway, W.2, architects for J. G. Ingram and Sons', Prince Edward Rd, E.9, factory.—Bonstan Engineering Co., 24 Runton St, N.19, plan extensions.—Crosher and James, 329 High Holborn, W.C.1, quantity surveyors for Worshipful Company of Innholders' Coleman St additions.—Brixton Development Co., Ely Pl, E.C.1, plan multi-storey industrial and office block, shops, maisonnettes and flats, Hatton Gdn/Leather La, E.C.1.—A. Kenyon, Taute and Ptnrs, 140 Park La, W.1, architects for Camberwell Grove, S.E.5, offices and dwellings.—Lutyens and Greenwood, 13 Mansfield St, W.1, architects for Royal Institute of International Affairs' £50,000 extensions at St. James's Sq, S.W.1.—F. N. Bateman, 81 High St, Wimbledon Common, S.W.19, agents for Norman Property Co.'s 101 flats, Priory La, S.W.15.—Veale and Sanders, 19 Hanover Sq, W.1, quantity surveyors for Berners St, W.1, offices and showrooms.—W. R. Orme and Ptnrs, 44 Manchester St, W.1, architects for Druce and Co's shop and office plan at Baker St and Broadstone Pl, W.1.—Royal Institution of Chartered Surveyors plan new H.Q. building at 11-12 Gt. George St, S.W.1.—C. Lovett Gill, 41 Russell Sq, W.C.1, architect for 12-storey block of shops and offices, Victoria St, S.W.1.—City of London Real Property Co. plan ten-storey building on Gorringe's Hotel site, 1-9 Warwick Rd and 25 Allington St.

Loughborough. Scheme for 13 Group "A" 400 W mercury fluorescent lamps at Derby Rd and 31 250 W mercury fluorescent lamps at Bishop Meadow Rd at £840 and £1,930.

Manchester T.C. Tender: Alterations and additions to St. Thomas C.E. School, Ardwick. Architect.

Margate. Tender: Factory at Westwood, for Pearce Signs Ltd. Prall and Prall, 57 High St, Bexley, Kent. Architects.

Middlesbrough B.C. Tender: Tropical and sub-tropical houses, Stewart Park; electric lighting and power with complete low pressure heating suitable for tropical and sub-tropical plants. Engineer.—B.C. Tenders: Easterside Group 29, 26 and 30, for 30 houses, 21 houses and 28 houses with flats and garages. Engineer.

Newcastle T.C. Tender: Installation of two automatic passenger lifts in each of two 15-storey flats blocks, Longbenton estate, Unit 4. Architect.

Newport, Mon. Stage one of Royal Gwent Hospital rebuilding scheme (£1½ million) to begin soon. It includes four operating theatres and kitchens. Welsh Regional Hospital Board, Cathays Park, Cardiff.

Norwich. T.C. plans £40,300 North Park Ave hostel for old people.

Notts T.C. Education programme includes £62,000 Newark training centre and £21,000 extensions to Mapperly training centre.—T.C. plans improved lighting schemes for Sneinton Hollows, Castle St, etc., at £1,110.

Oxford. G. R. Cooper (Oxford), St. Ebbes Corner, Oxford, plan four-storey warehouse with offices and showrooms, Paradise St.

Portsmouth. Birch and Jacques (Toolmakers), Hersham Trading Estate, Hersham, Walton-on-Thames, plan Leigh Park factory.

Redruth. Cornwall C.C. approve plans for £59,775 psychiatric old people's home and £54,950 junior/adult mental health training centre, Drump Rd.

Rochester. Yorke, Rosenberg and Mardall, 2 Hyde Park Pl, W.2, architects for Elliott Bros.' £336,000 electronics factory.

Royston U.D.C. Tender: 76 Doles estate dwellings. Surveyor.

Salisbury. Extensions and rebuilding of Godolphin School approved by T.C. Plans include new boarding house, modernisation of existing boarding houses, kitchens and dining rooms.

Sandwich B.C. £1,217 plan for 35 ft concrete standards with metal extensions, Ramsgate Rd; and 25 ft concrete standards at Dover Rd, £1,581 and £1,217.

Shrewsbury. Education Committee plan £77,700 scheme for additional accommodation at Walford Farm Institute, and similar £44,000 scheme at Radbrooke College of Domestic Science.

Southall B.C. Scheme for 140 W lamps, Tentelow La.

Sowerby Bridge U.D.C. Tender: 38 bungalows and meeting room, Bairstow La. Engineer.

Sunderland. Newrick and Blackbell, 58 John St, architects for Ericsson Telephones works extensions.—Corporation plans Town End Farm estate shopping centre. Borough Architect.—Junior and infant school planned on Town End Farm estate. Architect.

Sutton and Cheam B.C. Tender: 36 living units in one- and two-storey construction on two sites. Engineer.

Warwickshire. Health Committee plans £40,550 clinic at Warwick.—Loveday and Davis, 42 Regent Pl, Rugby, architects for old people's home.

Welwyn Garden City. Paul Manger, Gavin, Mathers and Mitchell, 31 Church St, Welwyn, architects for £40,000 hostel for National Spastics Society.

West Kesteven R.D.C. Tender: 20 dwellings in Westborough and Skillington parishes. Surveyor, Sandon Cl, Grantham.

Weston-super-Mare B.C. Tender: 26,000 sq ft factory with two-storey offices. Clerk.

Worcester. £22,000 extensions to Royal Infirmary planned.

Wrexham B.C. Tender: 66 dwellings, Montgomery Rd; and 14 dwellings, Lorne St/Park St. Surveyor.

GAZETTE ANNOUNCEMENTS

COMPANIES ACTS

Merseyside Eng. (Refrigeration) Ltd. Petition for winding-up to be heard before the High Court of Justice, Strand, W.C.2, on 19 Dec. Persons intending to appear to notify Slaughter and May, 18 Austin Friars, E.C.2, by 1 p.m., 17 Dec.

J. and D. Clayton (Edgware) Ltd. Petition for winding-up to be heard before the High Court of Justice, Strand, W.C.2, on 19 Dec. Persons intending to appear to notify Isadore Goldman and Son, 11-13 Southampton Row, W.C.1, by 1 p.m., 17 Dec.

Hobson and Hammond (Electrical) Ltd. Meeting of creditors to be held at 93 Queen St, Sheffield 1, on 15 Dec., at 11.15 a.m.

Pearl Industries Ltd. Mr P. R. Hackett, 18 Greenfield Cres, Edgbaston, Birmingham 15, appointed liquidator at extraordinary general meeting on 24 Nov.

Don Electrical Co. Ltd. Mr P. Cardwell, 93 Queen St, Sheffield 1, appointed liquidator at extraordinary general meeting on 28 Nov.

Reeves Electrical and Radio Co. Ltd. Meetings of creditors and contributories to be held at Room 401, Inveresk Hse, 346 Strand, W.C.2, on 15 Dec., at 2.30 and 3 p.m.

Safe-Beam Lamp Ltd. Dividend per £: 2s, payable at Official Receiver's Office, Somerset Hse, 27 Temple St, Birmingham 2, on 22 Dec.

Oldham Electrical Co. Ltd. Meetings of members and creditors to be held at offices of Poppleton and Appleby, 31 Lloyd St, Manchester 2, on 21 Dec., at 10 and 10.30 a.m., respectively, for the purpose of having an account of liquidation laid before them.

Madras Electric Supply Corpn. Ltd. General meeting of members to be held at 30 Cursitor St, E.C.4, on 30 Dec., at 11.35 a.m., to receive the liquidator's account of the winding-up.

Perryvale Electrical Appliances Ltd. Meeting of creditors to be held at Room 43, Winchester Hse, Old Broad St, E.C.2, on 16 Dec., at 2.45 p.m.

Kendridge Ltd. Mr. R. A. Hawken, Bank Chambers, 1 John St, W.C.1, and Mr. G. A. Wade, Walter Hse, 418-422 Strand, W.C.2, appointed liquidators at extraordinary general meeting on 14 Nov. for the purpose of voluntarily winding-up.

Gould, Roberts and Co. Ltd. Mr. S. Chater, 35 Windsor Pl, Cardiff, appointed liquidator at extraordinary general meeting on 14 Nov. for the purpose of voluntarily winding-up.

Partnerships Dissolved

Northampton. Partnership between W. White and T. F. Cave, electrical engineers and contractors, carrying on business as T. F. Cave and Co., at 11 Marefair, Northampton, dissolved as from 30 Nov. All debts to be paid by T. F. Cave who is carrying on the business.

St. Mary Cray. Partnership between G. F. Smith and F. H. C. Bishop, radio, television and electrical installation engineers, carrying on business as Wellington Electrics, at 31 High St, St. Mary Cray, dissolved as from 1 Sept., 1959. All debts to be paid by F. H. C. Bishop, who is carrying on the business.

BANKRUPTCY ACTS

Receiving Orders

Leeds. J. W. McEvoy, electrical appliance dealer, carrying on business as Domestic Electrics at 246 Easterly Rd, Leeds 8. Receiving order dated 2 Dec.

Edmonton. L. Smith, electrical retailers, carrying on business as Smiths Electrics at 134 Chase Side, Enfield. Receiving order dated 24 Nov.

Public Examinations

Bradford. H. Rose, electrical wholesaler, carrying on business at 5 Carlisle Terr, Bradford 8. Public examination: 10.30 a.m., 20 Feb., at County Court, Manor Row, Bradford 1.

Croydon. T. Hall, electrical dealer, of 36 Homefield Rd, Old Coulsdon. Public Examination: 11 a.m., 16 Feb., at County Court, Scarbrook Rd, Croydon.

Manchester. E. Humphreys, electrical dealer, etc., formerly carrying on business in partnership as J. and H. Supplies at 466-468 Rochdale Rd, Harpurhey. Public examination: 10.30 a.m., 27 Jan, at Court Hse, Quay St, Manchester 3.

Sheffield. F. C. Turner, domestic appliance dealer, electrical and motor engineer, formerly carrying on business as Ross Electrics, Ross Eng. and as Eros Security, at 112 Sepulchre Gate, 14 Bentinck St, 28 Springwell La, Balby, 18 South Parade and Cherry La, Marshgate, all at Doncaster; and at 127 Hessle Rd and 127 Spring Bank, Hull, at 2 Green St, Huddersfield, and at 9 Eldon Terr, Leeds 1. Public examination: 2 p.m., 2 Feb., at County Court Hall, Bank St, Sheffield 1.

Bolton. Television Services, electrical equipment, sales and service engineers, of 8 Longsight Rd, Holcombe Brook, Bury. Public examination: 10.30 a.m., 1 Feb., at Court Hse, Mawdsley St, Bolton.

Newport. R. G. Fitzpatrick, domestic appliance retailer, formerly carrying on business as South Wales Vacuum Services, at 7 Westgate Chmbrs. Public examination: 10.30 a.m., 19 Jan., at Law Courts, Civic Centre, Newport, Mon.

Oxford. T. W. R. Last, electrical retailer, formerly carrying on business as Oxford Washing Machine, Vacuum Cleaner and Refrigeration Specialists, at 33 Cowley Rd. Public examination: 11.15 a.m., 16 Jan., at County Hall, New Rd, Oxford.

Wigan. D. Hodson, hardware and electrical dealer, carrying on business as Service, at 71 Shuttle St, Tyldesley. Public examination: 11 a.m., 13 Feb., at Court Hse, Crawford St, Wigan.

Applications for Discharge

High Court of Justice. J. C. A. Drew, electrical goods dealer, formerly carrying on business as K. Roberts Electrical, at 1-3 Oglander Rd, S.E.15. Application for discharge to be heard at Bankruptcy Bldgs, Carey St, W.C.2, on 12 Jan., at 11 a.m.

Slough. D. MacIntyre, electrical engineer, of Flat 1, Mayfield, Bray Rd, Maidenhead. Application for discharge to be heard at Law Courts, Windsor Rd, Slough, on 18 Jan., at 10.30 a.m.

Wandsworth. C. D. Chappell, electrical engineer, etc., lately carrying on business as Chappell Bros. at 304 Balham High Rd, S.W.17. Application for discharge order made on 17 Oct.: discharged subject to certain conditions.

Dividend

Gt. Yarmouth. D. E. Pitchers, radio and electrical engineer, formerly carrying on business at 13 Tann La, Caister-on-Sea. Dividend per £: 1s 6d, payable at Official Receiver's Office, Norfolk Hse, Exchange St, Norwich, on 20 Dec.

Intended Dividend

Merthyr Tydfil. T. R. Thomas, electrical contractor, and E. Jones, television and radio engineeer, carrying on business in partnership as T. R. Thomas and Co. at "Golden Key," Union St, Dowlais. Last day for receiving proofs for intended dividend: 16 Dec., to trustee: G. H. Down, 106 Walter Rd, Swansea.

Release of Trustee

Liverpool. G. Dickinson and K. G. Dickinson, electricians, carrying on business at 134 Clipsley La and 321 Church Rd, Havdock. Trustee: Henry S. Oliver, 5 Rumford Pl, Liverpool 3, released as from 24 Nov.

Appointment of Trustees

Bradford. P. W. Nelson, retailer and engineer, formerly carrying on business as S.R. Services at 551 and 543 Wakefield Rd and at 32 Town Gate, Wyke. Mr. R. W. Hellver, Brotherton Chambers, Westgate, Leeds 1, appointed trustee as from 21 Nov.

Chester. I. M. Robinson, radio, television and electrical dealer, carrying on business as Robinson's Radio, TV and Electrical Services, at 4 Down Hill, High St, Bagilt, and 44 Castle St, Caergwrie, Flint. Mr R. P. Booth, 5 Rumford Pl, Chapel St, Liverpool 3, appointed trustee as from 21 Nov.

MEETINGS TO NOTE

THURSDAY, 15 DEC.

I.E.E. (Education Circle). Discussion: "How to Pass Examinations or the Psychology of Study." Savoy Pl, W.C.2. 6 p.m.

I.E.E. (Southern). Annual dinner and dance. The Polygon Hotel, Southampton.

I.E.E. (Irish). "Terminal Equipment for High Voltage D.C. Schemes," Professor C. T. G. Dillon. Physical Laboratory, Trinity College, Dublin. 6 p.m.

Institution of Mechanical Engineers (Nuclear Energy Group). Discussion: "The Impact of a Three-Fuel Economy." Birdcage Walk, S.W.1. 6 p.m.

Chelmsford Engineering Society. "The Genealogy of Remote Control." A. L. Hancock. Crompton's Social Hall. 7.30 p.m.

S. Wales Institute of Engineers. "Experiments in S. Wales with an Instrumented Coal Plough." L. Finkelstein, W. T. A. Morgans, C. D. Pomeroy and V. M. Thomas. Institute Bldgs, Park Pl, Cardiff. 6 p.m.

Diesel Engineers and Users' Association. "Report on Diesel Engine Working Costs and Performance 1959-60." Institute of Marine Engineers, 76 Mark La, E.C.3. 2.30 p.m.

Institution of Production Engineers (Southern). "Electronic Data Processing Allied to Production Engineering." F. W. Purchall. George Hotel, King St, Reading. 7.30 p.m.

Society of Instrument Technology (Chester). Joint meeting with North Wales Metallurgical Society. "Instrumentation in Steelmaking." N. P. Bacon. Blossoms Hotel. 7 p.m.

A.S.E.E. (S. London Branch). "Management and Utilisation." Greyhound Hotel, High St, Croydon. 8 p.m.

FRIDAY, 16 DEC.

I.E.E. (Mersey and N. Wales). "The Logmotor—A Cylindrical Brushless Variable-Speed Induction Motor," Prof F. C. Williams, E. R. Laithwaite, J. F. Eastham and L. S. Piggott. Town Hall, Chester. 6.30 p.m.

A.S.E.E. (Stoke and Crewe). "The Factories Act and the Electrical Engineer," G. L. Leighton. Grand Hotel, Hanley. 7.30 p.m.

Junior Institution of Engineers. Presidential address: "The Development Engineer in the Petroleum Industry." E. S. Sellers. Pepys Hse, 14 Rochester Row, S.W.1. 7.30 p.m.

SATURDAY, 17 DEC.

A.S.E.E. Gala Ladies' Night. Connaught Rooms, Gt. Queen St, W.C.2.

MONDAY, 19 DEC.

I.E.E. (Sheffield). Discussion: "Electrical Safety in Factories" and on "Electricity Supply Systems." Angel Hotel, Brigg. 7 p.m.

Institution of Mechanical Engineers (Steam Group). Discussion: "Safety on Construction Sites." Birdcage Walk, S.W.1. 6 p.m.

A.S.E.E. (Bristol and West). "Electricity in the Tobacco Industry," J. H. Quick. Grand Hotel, Bristol. 8 p.m.

TUESDAY, 20 DEC.

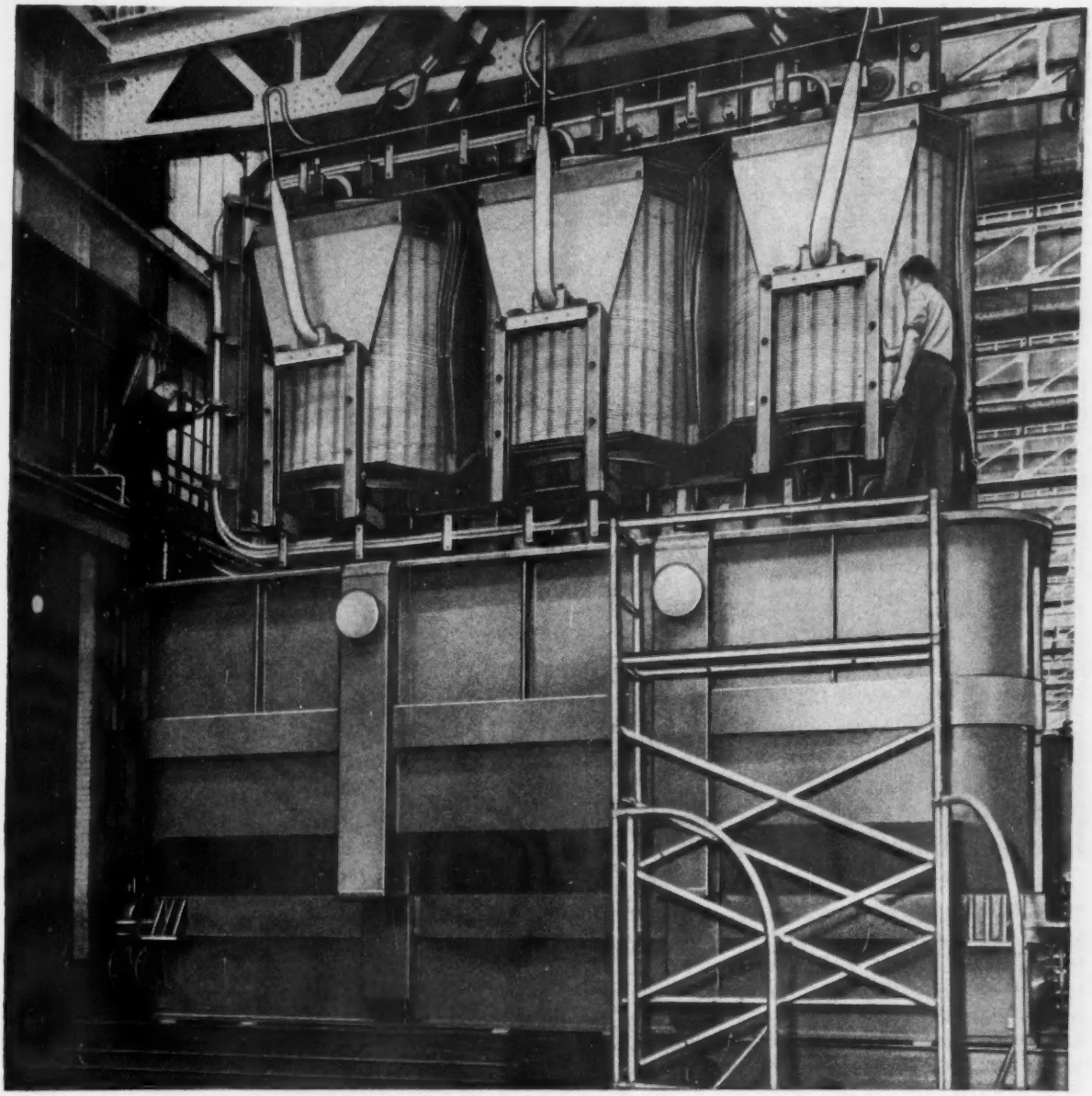
I.E.E. (Measurement and Control Section). Discussion: "Digital Transducers." Savoy Pl, W.C.2. 5.30 p.m.

A.S.E.E. "Electrical Control of Heating and Air-conditioning Plants," D. H. Powell. I.E.E. Lecture Theatre, Savoy Pl, W.C.2. 6.30 p.m.

WEDNESDAY, 21 DEC.

I.E.E. (Electronics and Communications Section). "Microminiaturisation," L. J. Ward. Savoy Pl, W.C.2. 5.30 p.m.

Institution of Plant Engineers (Kent). "Principles of Instrumentation," D. Mooney. King's Head Hotel, High St, Rochester. 7 p.m.



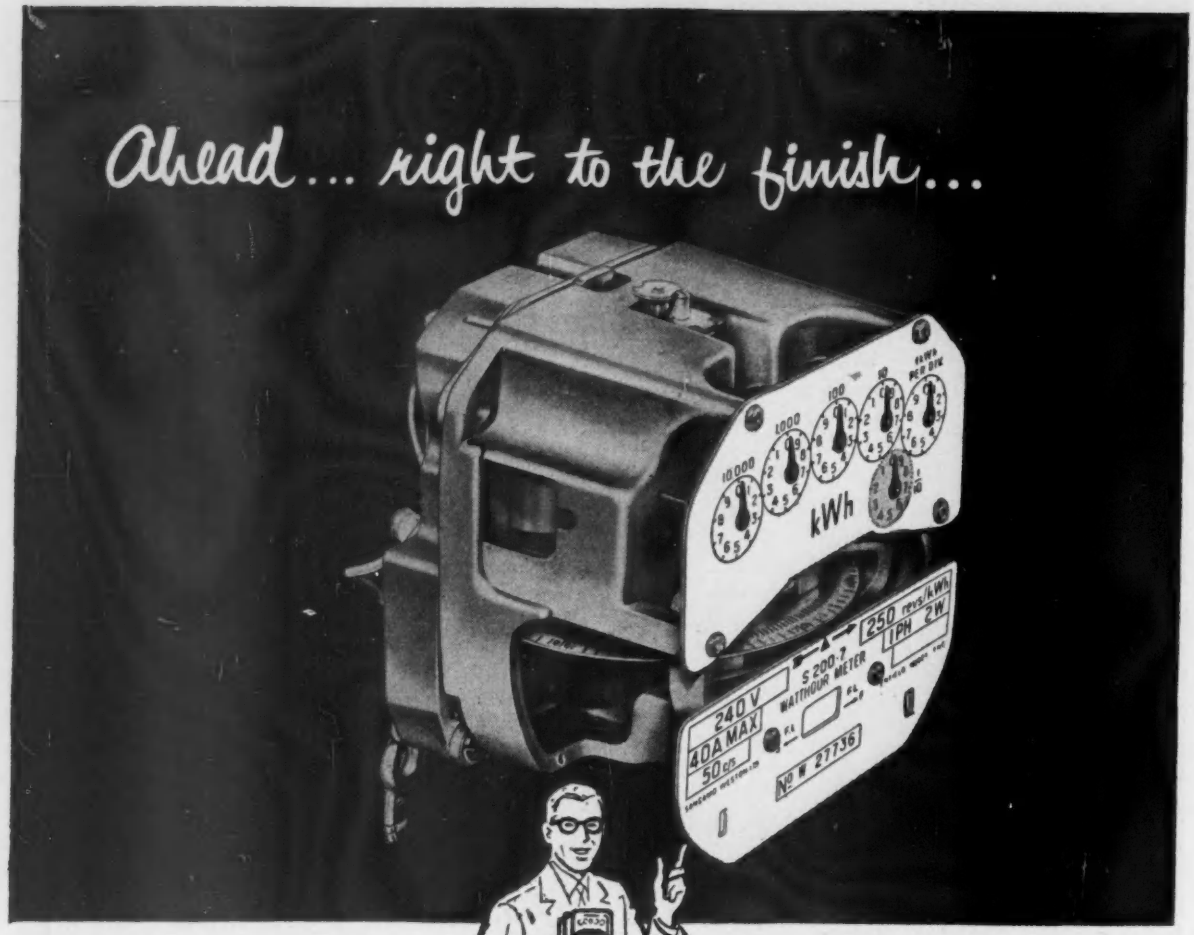
HACKBRIDGE TRANSFORMERS

The core and coil assembly of a 180 MVA 275/132 kV type ON/OFB auto transformer being lowered into its tank.

LARGEST SIZES
HIGHEST VOLTAGES

HACKBRIDGE AND HEWITTIC ELECTRIC COMPANY LIMITED
HERSHAM WALTON-ON-THAMES·SURREY Telephone: Walton-on-Thames 28833 (8 lines) Telegrams & Cables: Electric Walton-on-Thames

Ahead... right to the finish...



The external finish of the Sangamo Model S200 Meter is taken care of by Bakelite mouldings—proved by more than 25 years of complete satisfaction. The internal finishes reflect the tremendous care in the choice of materials and finishes which has made the S200 the most advanced Watthour Meter of the day. Quantity production in the world's most modern meter factory leads in turn to production economies which are passed on to the user in the form of finer materials, finer specification . . . in short, a better meter for the money.

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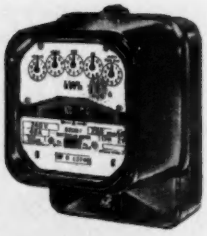

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Years ahead of its time!

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CLASSIFIED ADVERTISEMENTS

CHRISTMAS

Dec 22 Advertisements for this issue can be accepted up to 10 a.m.
Monday, 19 December.

Dec. 29 Advertisements for this issue can be accepted up to 10 a.m.
Friday, 23 December.

TENDERS INVITED

BOROUGH OF DROITWICH
Street Lighting-District Roads

TENDERS are invited from experienced contractors for the supply, delivery and erection of 52 No. Street Lamps in District Roads, together with wiring, lanterns and auxiliary gear.

Conditions of Contract and plan may be inspected at, and Specification, Bills of Quantities and Form of Tender obtained from the Borough Engineer and Surveyor, Town Hall, Droitwich, during normal office hours upon payment of a deposit of £2 2s, which sum will be returned on receipt of a bona fide tender and the return of all documents.

Tenders, in plain sealed envelopes, endorsed "Street Lighting—District Roads," to be delivered to the undersigned not later than 10 a.m. on Monday, 2 Jan., 1961.

The Council do not bind themselves to accept the lowest or any tender.

S. G. FOSTER,
Town Clerk.

Town Hall,
Droitwich,
Worcs.
6 Dec., 1960. (T 135)

GHANA SUPPLY COMMISSION
Tenders for Supply of Electric Cables

THE Ghana Supply Commission invite manufacturers to submit tenders for the following:

Tender Reference	*Description*
ELEC. 4023/1	61,000 yards Low Voltage Underground Cable, various sizes.
ELEC. 4024/1	29,000 yards High Voltage Underground Cable, various sizes.

Forms of tender and Condition of Contract are obtainable as from 15 Dec., 1960, on payment of a fee of £G1 from The Secretary, Ghana Supply Commission, Post Office Box M.35, Accra, Ghana. The closing date for receipt of tenders will be 23 Jan., 1961. (T 157)

APPOINTMENTS VACANT

CENTRAL ELECTRICITY GENERATING BOARD
South Eastern Division

LITTLEBROOK POWER STATION
OPERATION SUPERINTENDENT
Vacancy No. 32AT/60.

CANDIDATES should have held a responsible post in a modern generating station, and possess technical and practical qualifications. Experience in oil firing would be an advantage.

Salary: N.J.B. Class L, Grade 4, £1,855/£2,010 per annum, including London Allowance.

Applications giving age, details of experience, qualifications, etc., should be sent to the Station Superintendent, Littlebrook Power Station, nr. Dartford, Kent, to arrive by 30 Dec., 1960. Please quote vacancy number when applying.

W. H. DUNKLEY,
Divisional Controller.
(T 144)

SOUTHERN ELECTRICITY BOARD

ASSISTANT ENGINEER
(MAINTENANCE AND OPERATION)
OXFORD DISTRICT OF No. 2 (NEWBURY) SUB-AREA

SALARY: N.J.B. Class J, Grade 9 (£1,115/£1,245 per annum). N.J.B. Conditions of Service.

The duties of the post will be to assist with the maintenance and operation of H.V. and L.V. distribution mains and substations and with minor construction work. A technical training to H.N.C. standard and experience of similar work are required. A regular users' car allowance will be available.

Applications on forms obtainable from the Sub-Area Secretary, 7 Oxford Rd, Newbury, Berks, and returned to him, quoting Z.1272, not later than 28 Dec., 1960.

ASSISTANT ENGINEER
(MAINTENANCE AND OPERATION)
READING DISTRICT OF No. 2 (NEWBURY) SUB-AREA

Salary: N.J.B. Class J, Grade 11 (£965/£1,090 per annum). N.J.B. Conditions of Service.

The duties of the post will be to assist with the maintenance and operation of H.V. and L.V. distribution mains and substations and with minor construction work. A technical training to H.N.C. standard and experience of similar work are required.

Applications on forms obtainable from the Sub-Area Secretary, 7 Oxford Rd, Newbury, Berks, and returned to him, quoting Z.1279, not later than 28 Dec., 1960.

FIELD ENGINEERS (CONSTRUCTION)
FOUR VACANCIES
CONSTRUCTION SECTION OF No. 4 (BOURNEMOUTH) SUB-AREA

As follows: South Sub-Section (based on Bourne Valley, Branksome, Poole)—Two vacancies.

North Sub-Section (based on West Hendford, Yeovil)—One vacancy.

East Sub-Section (based on Winchester)—One vacancy.

Salary in each case N.J.B. Class L, Grade 13 (£965/£1,090 per annum). N.J.B. Conditions of Service.

The duties of the post will be to carry out the installation and erection of plant, equipment and overhead lines, the laying of cables and other constructional work by direct labour and/or Contract on all distribution systems up to and including 33,000 V.

Applications on forms obtainable from the Sub-Area Secretary, 1 Priory Rd, Bournemouth, and returned to him, quoting Z.1295, not later than 28 Dec., 1960.

GENERAL ASSISTANT ENGINEER
BOURNEMOUTH DISTRICT OF No. 4 (BOURNEMOUTH) SUB-AREA

Salary: N.J.B. Class J, Grade 12 (£890/£1,015 per annum). N.J.B. Conditions of Service.

Applicants should have had sound experience in the design, construction, operation and maintenance of H.V. and L.V. overhead and underground distribution mains and substations. The possession of suitable technical qualifications would be an advantage. The successful candidate will be required to carry out standby duties if and when called upon to do so.

Applications on forms obtainable from the Sub-Area Secretary, 1 Priory Rd, Bournemouth, and returned to him, quoting Z.1293, not later than 28 Dec., 1960.

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DEMONSTRATOR
SWINDON DISTRICT OF No. 2 (NEWBURY) SUB-AREA

Salary: N.J.C. Grade 1 (£600/£700 per annum). N.J.C. Conditions of Service.

Applicants should be qualified to advise generally on the utilisation of electric domestic appliances, to give public demonstrations of apparatus and to assist in showroom duties. The possession of an E.A.W. Certificate or equivalent Domestic Science qualification would be an advantage.

Applications on forms obtainable from the Sub-Area Secretary, 7 Oxford Rd, Newbury, Berks, and returned to him, quoting Z.1206, not later than 28 Dec., 1960.

The successful candidates for the above appointments will be required to contribute to the Electricity Supply (Staff) Superannuation Scheme, if eligible. (T 149)

CENTRAL ELECTRICITY GENERATING BOARD
Eastern Division

APPLICATIONS are invited for the following appointment:

ASSISTANT ENGINEER (INSTRUMENTS)
SOUTH DENES (GREAT YARMOUTH) GENERATING STATION (NORFOLK)

Salary: N.J.B., Class J, Grade 6, Scale 12, £1,350/£1,500 per annum.

Applicants who applied as a result of the recent advertisement, need not re-apply as they will automatically be reconsidered.

Applicants must be qualified to Higher National Certificate standard or equivalent and should have sound technical and practical experience in the construction, testing, repair and maintenance of modern generating station instruments.

A good knowledge of electronics, also electrical and pneumatic control systems is essential.

Applications, quoting reference S.V. No. 1400, stating age, qualifications, experience and present position, should be sent to the Controller, Central Electricity Generating Board, Eastern Division, West Farm Pl, Chalk La, Cockfosters, Barnet, Herts, by 31 Dec., 1960. (T 126)

SOUTH OF SCOTLAND ELECTRICITY BOARD
Clyde Area

THIRD ASSISTANT DISTRICT ENGINEER
(RENFREW DISTRICT)

APPLICATIONS are invited for the above position.

Applicants should have experience of both H.V. and L.V. underground and overhead distribution systems, including switchgear.

The possession of the Higher National Certificate or equivalent qualification is desirable.

The conditions of employment will be in accordance with the National Joint Board Agreement and the salary in terms of that agreement, viz.: Class G, Grade 9, £965/£1,090 per annum.

Applications on the appropriate form, obtainable from this office, should be sent to the undersigned within 14 days of the appearance of this notice.

H. B. BRUCE,
Manager.

P.O. Box 15,
206 St. Vincent St,
Glasgow C.2.
8 Dec., 1960. (T 153)

Advertisements should be sent to the Classified Advertisement Dept., Electrical Times, Sardinia House, Sardinia Street, London, W.C.2, before 10 a.m. on TUESDAY of the week of issue. Official Displayed Advertisements are charged at 40s. per inch, and all other classified advertisements at 3s. per line. Situations Wanted four insertions at twice the single insertion rate. Fee for Box Number and postage on replies 2s.

MIDLANDS ELECTRICITY BOARD

APPLICATIONS are invited for the following superannuable posts:

North Staffs Sub-Area

SECOND ASSISTANT DISTRICT ENGINEER (LEEK/CONGLETON)

Duties include the construction, operation and maintenance of H.V. and L.V. underground mains and overhead lines and substations, up to and including 33 kV, and applicants should have had experience in the planning of system reinforcements and mains extensions. Technical qualifications desirable. Salary: £1,115/£1,245 per annum (N.J.B. Grade G.7). Apply, by letter, within 14 days, stating age, experience, present position and salary to Mr C. C. Pimble, Sub-Area Manager, Midlands Electricity Board, 234 Victoria Rd, Fenton, Stoke-on-Trent.

South Staffs and North Worcs Sub-Area

SECOND ASSISTANT COMMERCIAL ENGINEER (HEADQUARTERS)

Applicants should be well experienced in the preparation of specifications and quotations for industrial, commercial and domestic installations, also in the planning and supervision of large installations. A good knowledge of modern industrial processes is essential. Appropriate technical qualifications desirable. Salary: £1,535/£1,720 per annum (N.J.B. Grade M.7).

SENIOR DEMONSTRATOR (COMMERCIAL DEPARTMENT) (HEADQUARTERS)

Duties will include recruitment of Electrical Housecraft Advisory Staff, supervision of trainees and co-operation with Districts regarding all aspects of sales, housecraft advisory service, demonstrations, etc. Possession of Domestic Science qualifications and a current driving licence essential. Salary: £1,020/£1,140 per annum (N.J.C. Grade 5).

Apply, by letter, within 14 days, stating age, experience, present position and salary, to Mr H. A. P. Caddell, Sub-Area Manager (Ref. EMI/SEC), Midlands Electricity Board, P.O. Box No. 9, Toll End Rd, Tipton, Staffs.

Worcester and District Sub-Area

SECOND ASSISTANT DISTRICT ENGINEER (KIDDERMINSTER)

Experience necessary in all branches of distribution work, including construction, maintenance and operation of high and low voltage underground and overhead systems and substations. Technical qualifications desirable. Salary: £1,040/£1,165 per annum (N.J.B. Grade F.7). Apply, by letter, within 14 days, stating age, experience, present position and salary, to District Manager, Midlands Electricity Board, New Rd, Kidderminster.

F. W. CATER,
Secretary.
(T 133)

CITY OF MANCHESTER

APPLICATIONS invited for the appointment in the office of the City Architect, of an

ASSISTANT ELECTRICAL ENGINEER (PERMANENT)

Salary: APT. II, £815/£960 per annum. Candidates should preferably have passed section A or Joint Part I of the examination of the Institution of Electrical Engineers or the Higher National Certificate. Should be capable of supervising work in progress on electrical lighting and power installations in all classes of buildings.

Five-day week. Removal expenses allowed.

Forms of application from the City Architect, P.O. Box 488, Town Hall. Returnable by 30 Dec., 1960. (T 142)

BOROUGH OF BARKING

Borough Engineer and Surveyor's Department

APPLICATIONS are invited for the following permanent appointment:

THIRD ENGINEERING ASSISTANT (ELECTRICAL AND MECHANICAL)

Within Grade APT I—£645/£815, plus appropriate London Weighting.

Candidates must have gained experience in the installation and maintenance of heating and electrical systems after serving as an apprentice with a reputable firm. They should hold, in whole or in part, the appropriate National Certificate or equivalent qualification.

Local conditions include pleasant modern offices in a new Town Hall and a substantial number of Saturday mornings free of duty.

Further particulars and application forms may be obtained from the Borough Engineer and Surveyor, Town Hall, Barking, and must be returned to the undersigned not later than 9 a.m. on Wednesday, 28 Dec., 1960.

E. R. FARR,
Town Clerk.

Town Hall,
Barking. (T 121)

THE SOUTH WALES ELECTRICITY BOARD

DISTRICT MANAGER
RHONDDA DISTRICT

APPLICATIONS are invited for the post of Manager of the Rhondda District in the Cardiff and East Central Area.

The District serves an important and varied community in the Rhondda Valley area.

Experience in a senior position in the Electricity Supply Industry is essential, and applicants should possess a recognised professional qualification.

The salary for the position will be in accordance with Class C, Grade 5, of the National Joint Managerial and Higher Executive Grades Committee, namely £2,170/£2,380 per annum.

The successful candidate will be required to commence duties on 1 Mar., 1961.

Applications should be sent to the undersigned at St. Mellons, Cardiff, to arrive not later than 16 Jan., 1961.

Please quote reference 218/60/ET, endorsing envelope "District Manager, Rhondda."

R. G. WILLIAMS,
Secretary.
(T 136)

CENTRAL ELECTRICITY GENERATING BOARD

Eastern Division

APPLICATIONS are invited for the following appointment:

ASSISTANT ENGINEER (INSTRUMENT)
LITTLE BARFORD GENERATING STATION (ST. NEOTS, HUNTS)

Salary: N.J.B., Class J, Grade 7, Scale 11, £1,275/£1,410 per annum.

Applicants must be qualified to Higher National Certificate standard or equivalent and should have sound technical and practical experience in the construction, testing, repair and maintenance of modern generating station instruments.

A good knowledge of electronics, also electrical and pneumatic control systems is essential.

Applications, quoting reference S.V. No. 1414, stating age, qualifications, experience and present position, should be sent to the Controller, Central Electricity Generating Board, Eastern Division, West Farm Pl, Chalk La, Cockfosters, Barnet, Herts, by 31 Dec., 1960. (T 139)

CENTRAL ELECTRICITY GENERATING BOARD

South Eastern Division

CROYDON "B" POWER STATION
ELECTRICAL MAINTENANCE ENGINEER
Vacancy No. 227AT/60.

APPLICANTS should have had experience in the Maintenance of heavy electrical plant and switchgear and should possess H.N.C. in Electrical Engineering (Power). Experience in the control of labour is essential. Applicants should also be capable of carrying out Budgetary Control and setting out Specifications for electrical plant as required.

Salary: N.J.B., Class J, Grade 7, £1,325/£1,460 per annum, including London Allowance.

ASSISTANT ELECTRICAL MAINTENANCE ENGINEER
Vacancy No. 228AT/60.

Applicants should have had experience with the maintenance of heavy electrical plant, together with a knowledge of electrical testing, schematic circuits and protection systems and should possess H.N.C. in Electrical Engineering (Power). Experience in the control of labour is essential.

Salary: N.J.B. Class J, Grade 9, £1,165/£1,295 per annum, including London Allowance.

Applications giving age, details of experience, qualifications, etc., should be sent to the Station Superintendent, Croydon "B" Power Station, Beddington Farm Rd, Croydon, Surrey, to arrive by 30 Dec., 1960. Please quote Vacancy number when applying.

W. H. DUNKLEY,
Divisional Controller.
(T 143)

MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

SENIOR DEMONSTRATOR

REQUIRED in the Liverpool South District. Salary within range £700/£775 per annum (N.J.C. Grade 2).

Candidates should have a good knowledge of electrical appliances, and have previous experience as a Demonstrator, and be competent to supervise demonstrations on cooking, laundering and household subjects. Possession of a recognised diploma in Domestic Science, or other approved certificate is desirable.

Appointment subject to medical examination. Pension Scheme.

Apply by letter, giving personal details, to the Manager, No. 1 Sub-Area, 24 Hatton Gdn. Liverpool 3, not later than 30 Dec., 1960. (T 140)

KENT EDUCATION COMMITTEE

Gravesend Technical College

APPLICATIONS are invited for the appointment of

ASSISTANT LECTURER (GRADE A)

for City and Guilds Electrical Installation and Electrical Fitters Courses.

Candidates should be appropriately qualified with good industrial experience and some teaching experience is desirable.

Salary Scale: £520 x £27 10s—£1,000.

In fixing the salary increments may be allowed for industrial and/or professional experience.

Application forms and further particulars from the Principal, Technical College, Darnley Rd, Gravesend. (T 120)

MIDDLESEX COUNTY COUNCIL

County Architect's Department

ELECTRICAL ENGINEERING ASSISTANTS

REQUIRED. APT. II (£815/£960, plus London Weighting up to £40. Established. Prescribed conditions. Candidates must have had experience in preparation of drawings and specifications for lighting of public buildings.

Application forms (s.a.f'scap.e.) from County Architect, 1 Queen Anne's Gate Bldgs, Dartmouth St, S.W.1., returnable by 28 Dec. (Quote F.3.ET.). (T 138)

Box No. replies to be addressed to the ELECTRICAL TIMES, Sardinia House, Sardinia Street, London, W.C.2

CENTRAL ELECTRICITY GENERATING BOARD

East Midlands Division

GENERAL ASSISTANT ENGINEER
WARWICK POWER STATION
Vacancy No. 268/60.

APPLICATIONS are invited for the position of General Assistant Engineer at Warwick Power Station, Emscote Rd, Warwick.

The successful applicant will be given the opportunity to obtain operating and maintenance experience. Applicants should be in possession of suitable engineering qualifications.

The salary during the initial training period will depend upon qualifications and knowledge, and will be within the range £625/£805 per annum of the National Joint Board Agreement.

Closing date for receipt of applications: 23 Dec., 1960.

ASSISTANT SHIFT CHARGE ENGINEER
DRAKELOW "A" POWER STATION
Vacancy No. 269/60.

Applications are invited for the position of Assistant Shift Charge Engineer at Drakelow "A" Power Station, near Burton-on-Trent.

Applicants should have received a sound technical training and have had experience in a modern power station. Preference will be given to candidates who possess the Higher National Certificate, or its equivalent.

Salary will be in accordance with Class J, Grade 8 (£1,190/£1,325 per annum), of the National Joint Board Agreement, plus 10% allowance for shift duties.

Closing date for receipt of applications: 23 Dec., 1960.

GENERAL ASSISTANT ENGINEER
(CHEMIST)
NORTH WILFORD POWER STATION
Vacancy No. 273/60.

Applications are invited for the position of General Assistant Engineer (Chemist) at North Wilford Power Station, Queens Drive, Nottingham.

Candidates must have had a sound technical training and previous laboratory experience and should preferably hold the Higher National Certificate in Chemistry, but consideration will be given to candidates studying for that qualification.

The salary will be within the range £625/£805 per annum of the National Joint Board Agreement.

Closing date for receipt of applications: 30 Dec., 1960.

GENERAL ASSISTANT ENGINEER
(CHEMIST)
(MALE OR FEMALE)
WILLINGTON POWER STATION
Vacancy No. 274/60.

Applications are invited for the position of General Assistant Engineer (Chemist) (Male or Female) at Willington Power Station, P.O. Box 27, Derby.

Candidates must have had a sound technical training and previous laboratory experience, and should preferably hold the Higher National Certificate in Chemistry, but consideration will be given to candidates studying for that qualification.

The salary will be within the range £625/£805 per annum of the National Joint Board Agreement.

Closing date for receipt of applications: 30 Dec., 1960.

STATION SHIFT CONTROL ENGINEER
DERBY POWER STATION
Vacancy No. 275/60.

Applications are invited for the position of Station Shift Control Engineer at Derby Power Station, Full St, Derby.

Applicants should have had a sound technical training and practical experience in a modern power station. The possession of a Higher National Certificate in Electrical Engineering, or its equivalent, would be an advantage.

Salary will be in accordance with Class F, Grade 10 (£825/£940 per annum) of the National Joint Board Agreement, plus shift allowance.

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Closing date for receipt of applications: 30 Dec., 1960.

These appointments will be pensionable within the terms and conditions of the Electricity Supply (Staff) Superannuation Scheme.

Applications should be submitted on the official form AE6/ACT, which may be obtained from the Station Superintendent concerned, and should be returned to him by the date stated.

O. S. WOODS,
Divisional Controller.
(T 146)

NORTH THAMES GAS BOARD

Westminster, S.W.1

DRAUGHTSMAN

REQUIRED for the design and layout of electrical lighting and power installations applicable to Gas Works.

Candidates should possess the Ordinary National Certificate in Electrical Engineering and be continuing their studies for the Higher National Certificate. They should be familiar with the preparation of contract specifications and have some industrial experience.

Salary will be within the range £715/£900 per annum in the Administrative, Professional and Technical Grades 5/7, according to qualifications and experience.

Five-day week. Contributory pension scheme.

Applications, stating age, qualifications and experience should be sent to the Staff Controller, North Thames Gas Board, 30 Kensington Church St, W.8, quoting reference ET/955. (T 152)

THE NORTH EASTERN ELECTRICITY BOARD

SECOND ASSISTANT ENGINEER

APPLICATIONS are invited for the appointment of a Second Assistant Engineer, Industrial Section, Sub-Area Commercial Officer's Department, Tees Sub-Area, with location at Thornaby-on-Tees. Applicants should have experience of the application of electricity to industry; a knowledge of the economics of electricity supply and tariff structure, and be capable of concluding negotiations for industrial supplies.

Salary: Schedule A, Class L, Grade 7, £1,440/£1,610 per annum. N.J.B. conditions of service.

Applications stating age, qualifications and experience, to be received by the Assistant Secretary (Establishments), The North Eastern Electricity Board, G.P.O. Box No. 117, Carliol Hse, Newcastle upon Tyne, within ten days of the appearance of this advertisement. (T 145)

YORKSHIRE ELECTRICITY BOARD

No. 3 (Sheffield) Sub-Area

FOURTH ASSISTANT ENGINEER
(METERS, TESTING AND PROTECTION)

APPLICANTS should hold the Higher National Certificate in Electrical Engineering or equivalent and have had experience in the testing and installation of industrial metering equipment.

Salary: N.J.B. Class N, Grade 13 (Scale 9), £1,115/£1,245 per annum.

Sub-Area Headquarters

ENGINEERING DRAUGHTSMAN (CIVIL)
(THREE POSTS)

Salary, General Assistant Engineer: N.J.B. Class N, Grade 19 (Scale 3), £715/£805 per annum, or N.J.B. Class N, Grade 18 (Scale 4), £765/£870, according to experience and qualifications.

Applicants should have had experience in the preparation of simple building drawings.

ENGINEERING DRAUGHTSMAN
(ONE POST)

Salary, General Assistant Engineer: N.J.B. Class N, Grade 19 (Scale 3), £715/£805 per annum.

Applicants should be capable of carrying out simple survey work and have had experience within the Electricity Supply Industry in mains recording and the preparation of drawings for mains extensions.

Sheffield Central District

ENGINEERING DRAUGHTSMAN
(ONE POST)
AT SUB-AREA HEADQUARTERS

Salary, General Assistant District Engineer: N.J.B. Class H, Grade 12 (Scale 5), £825/£940 per annum.

Ecclesfield District

ENGINEERING DRAUGHTSMAN
(ONE POST)
AT ECCLESFIELD DEPOT

Salary, General Assistant District Engineer: N.J.B. Class G, Grade 12 (Scale 4), £765/£870 per annum.

Applicants should have had experience of mains records work within the Electricity Supply Industry, and be capable of supervising cartographical draughtsmen.

The possession of the Ordinary National Certificate will be an advantage for all the above posts.

These posts offer an excellent opportunity to Draughtsmen who wish to take up a career in this rapidly expanding industry.

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Manager, No. 3 (Sheffield), Sub-Area, Yorkshire Electricity Board, Commercial St, Sheffield 1, not later than 30 Dec., 1960. (T 148)

BRUSH ELECTRICAL ENGINEERING COMPANY LIMITED

Loughborough, Leicestershire

(A member of the Hawker Siddeley Group—Industrial Division)

INDUSTRIAL APPLICATIONS ENGINEER

Due to expansion in the industrial applications field this Company has a vacancy for a SENIOR ENGINEER in the Industrial Application Section of the Electrical Rotating Machines Engineering Department. A knowledge of drives in the rubber, plastics and associated industries and of related control systems is essential. Some practical experience of site testing and commissioning is also desirable.

Applications are invited from fully qualified men and preference will be given to corporate members of the Institution of Electrical Engineers.

Applications, WHICH WILL BE TREATED IN THE STRICTEST CONFIDENCE, should contain brief details of experience and qualifications and should be addressed to Mr P. A. McCaig, quoting reference: PL.9904.

Brush Electrical Engineering Company Limited,
Loughborough, Leicestershire

(T 134)

SOUTH EASTERN ELECTRICITY BOARD

ASSISTANT ENGINEER
(OPERATION AND MAINTENANCE)
CROYDON AND WEST KENT
AREA HEADQUARTERS

SALARY: N.J.B. Class K, Grade 10, £1,165/£1,295 per annum, including London Allowance. Superannuable. Applicants should preferably be Corporate Members of the Institution of Electrical Engineers and should have had experience in the operation and maintenance of distribution systems up to and including 33 kV. Applications quoting ET and naming two referees on forms from the Croydon and West Kent Area Manager, Electric Hse, Wellesley Rd, Croydon, by 28 Dec., 1960.

SECOND ASSISTANT ENGINEER
(CONSTRUCTION)
CROYDON AND WEST KENT
AREA HEADQUARTERS

Salary under N.J.B. Class K, Grade 7, £1,400 x £30—£1,550 per annum, including London Allowance. Superannuable. Candidates should be Corporate Members of the Institution of Electrical Engineers and have a wide experience in the construction and commissioning of substations, overhead and underground distribution systems up to and including 33 kV. Applications quoting ET and naming two referees, on forms from the Croydon and West Kent Area Manager, Electric Hse, Wellesley Rd, Croydon, by 28 Dec., 1960.

SECOND ASSISTANT ENGINEER
(CONSTRUCTION)
ENGINEER-IN-CHIEF'S DEPARTMENT
HEADQUARTERS

Salary: £1440/£1,610 per annum, under N.J.B. Schedule B, Grade AX5. Superannuable. The duties attaching to this position require an experienced engineer, preferably a Corporate Member of the Institution of Electrical Engineers. The person appointed will be required to assist in the design and construction of substations up to 33 kV, and the preparation of specifications for plant and materials, including underground cable works and overhead lines. His duties will also embrace plant inspection and associated engineering problems. Applications quoting ET and naming two referees, on forms from the Engineer-in-Chief, Seeboard, 10 Queen's Gdns, Hove 3, Sussex, by 28 Dec., 1960.

DISTRICT MANAGER
WOKING DISTRICT

The district serves some 40,000 consumers over a developing area of 69 sq miles of urban and rural character. A heavy programme of modernisation work on the supply system is already under way and will take some time to complete. 1959-60 unit sales were 184 million (50% domestic, 35% industrial). Salary: £2,170/£2,380 per annum, in accordance with Class C, Grade 5, of N.J.M. and H.E. Grades Committee. Applications quoting ET and naming two referees on forms from Surrey Manager, Seeboard, Rough Rew, Ridgeway Rd, Dorking, by 2 Jan., 1961.

GEORGE WRAY,
Secretary.
(T 147)

FALKLAND ISLANDS GOVERNMENT

ASSISTANT DIESEL ELECTRIC MECHANIC
SOUTH GEORGIA

REQUIRED for service in South Georgia for one tour of 2-2½ years in first instance. The officer will be provided with free furnished accommodation and with free fuel and lighting. Meals will also be free. Free passages. Liberal leave on full salary. In addition he will be paid a salary according to experience and ability in scale rising to £540 a year. Gratuity at rate of £10 for each completed month of residential service.

Candidates, single and under 40 years of age, must be able to repair and maintain diesel electric (A.C.) generators up to 75 kW and service electrical equipment.

Apply to Crown Agents, 4 Millbank, London S.W.1, for application form and further particulars, stating age, name, brief details of qualifications and experience and quoting reference M2A/51163/EE. (T 150)

EASTERN ELECTRICITY BOARD

APPLICATIONS are invited for the following positions. Successful candidates will be required to contribute to a superannuation scheme and may be required to undergo a medical examination.

Chilterns Sub-Area

NORTHWOOD DISTRICT
FOURTH ASSISTANT ENGINEER
327/60.R.

Candidates should have had a sound technical training and experience in the construction, operation and maintenance of H.V. and L.V. underground systems, including substations.

Salary: N.J.B. Class F, Grade 11 (£765/£870), plus London Allowance.

Apply by letter to the Manager, Northwood District, Eastern Electricity Board, 1 Love La, Pinner, by 30 Dec., 1960.

Essex Sub-Area

SUB-AREA HEADQUARTERS
NEAR BRENTWOOD
GENERAL ASSISTANT ENGINEER
(PLANNING AND DEVELOPMENT)
326/60.R.

Candidates should have had a good technical education and possess the Higher National Certificate or equivalent qualification.

The position offers an excellent opportunity for obtaining experience over a wide field of planning work.

Salary: N.J.B. Class L, Grade 15 (£825/£940), plus London Allowance.

FOURTH ASSISTANT ENGINEER
(CONTROL)
328/60.R.

Candidates should have had a sound technical training and experience in the construction, operation and maintenance of overhead and underground distribution systems.

A knowledge of system protection is desirable.

Salary: N.J.B. Class L, Grade 13 (£965/£1,090), plus London Allowance, plus a shift allowance of 10%.

For these appointments apply by letter to G. M. Holland, M.I.E.E., A.M.B.I.M., Engineer, Essex Sub-Area, Eastern Electricity Board, "Millfield," Bentley, Nr. Brentwood, Essex, by 30 Dec., 1960.

Norfolk Sub-Area

SUB-AREA HEADQUARTERS, NORWICH
PRINCIPAL ASSISTANT (ACCOUNTANCY)
324/60.R.

Applications are invited from qualified accountants for the above post at Sub-Area Headquarters, the occupant of which is the first assistant to the Sub-Area Accountant.

The duties of the post include responsibility for the preparation of final accounts.

Candidates should have had wide general experience, including control of staff, and it would be an advantage to have had experience with mechanical systems.

Salary: N.J.C. Grade 9 (£1,530/£1,650).

Applications stating age, education, training, qualifications, experience and details of present responsibilities should be sent to the Manager, Norfolk Sub-Area, Eastern Electricity Board, 4 Duke St, Norwich, NOR.23A, by 30 Dec., 1960.

Northmet Sub-Area

HENDON DISTRICT
SECOND ASSISTANT ENGINEER
(Ref. 1022) 329/60.R.

Candidates should have had a sound technical training and considerable experience in the construction, operation and maintenance of underground distribution systems at voltages up to and including 33 kV.

Salary: N.J.B. Class G, Grade 7 (£1,115/£1,245), plus London Allowance.

Apply by letter to F. A. Moinet, M.I.E.E., Manager, Eastern Electricity Board, 137-139 Brent St, Hendon, by 30 Dec., 1960.

Fens Sub-Area

FITTER (ELECTRICAL)
PROTECTION SECTION
325/60.R.

Applications are invited for the position of Fitter (Electrical) to work with the Protection Section based at Thompsons La, Cambridge.

continued in next column

continued from previous column

Duties will include work in connection with the testing and commissioning of substations and protective gear over the whole Sub-Area.

N.J.I.C. rates and conditions. Present rate 5s 6½d for 42-hour five-day week.

Apply by letter to the Secretarial Officer, Fens Sub-Area, Eastern Electricity Board, Milton Hall, Milton, Cambridge, by 30 Dec., 1960. (T 151)

CAMBORNE SCHOOL OF METALLIFEROUS MINING, CAMBORNE, CORNWALL

ASSISTANT LECTURER, GRADE B

To Teach Electrical Engineering and Associated Subjects

QUALIFICATIONS: Degree in Engineering or Physics, or professional qualification in Electrical Engineering, with mining, industrial or teaching experience for which increments will be allowed. Salary: £700/£1,150 x £27 10s + qualification allowance on Burnham Scale. Facilities for research. Apply to the Secretary, who will be pleased to supply further information; state when available. (T 100)

CHARTERED ELECTRICAL ENGINEER

A VACANCY exists for a Chartered Electrical Engineer with a hydro-electric power undertaking in Northern Nigeria. Pleasant climate, 4,000 ft above sea level. Age 30 to 35. Salary grade £1,335/£1,565 according to age, qualification and experience. Pension and life assurance scheme. Eighteen months' tours with three months' leave on full salary. Free furnished quarters. Free passages self, wife and two children, or equivalent benefits if children remain at home. Write Box E.996, c/o Streets, 110 Old Broad St, E.C.2. (T 128)

DESIGNER

Applications are invited from Engineers with qualifications of at least H.N.C., preferably in Mechanical Engineering, for design and development work on M.V. circuit-breakers and fuse switchgear. Creative initiative and aptitude for design work is important, switchgear experience desirable.

Good salary and prospects with a company near the South Devon Coast. There is a non-contributory pension scheme, and housing accommodation will be available if required.

Apply, giving full details of qualifications and experience to the Chief Designer, Ottermill Switchgear Ltd., Ottery St. Mary, Devon. (T 49)

TILLOTSONS CORRUGATED CASES LTD.

A fully experienced shift maintenance Electrician is required for a modern factory producing and converting Corrugated Fibreboard. Assistance with housing will be considered. Applicants should be fully conversant with industrial power installations in which extensive use is made of d.c. and a.c. variable speed drives and automatic controls.

Full details of previous and present employment, age and rate required to be given in application, which should be addressed to:

Works Director,
Tillotsons Corrugated Cases Ltd.,
Burwell,
Cambridge.

SENIOR ESTIMATOR—ELECTRICAL

An expanding and progressive company situated near Birmingham requires a qualified Electrical Engineer (H.N.C. or equivalent) to take charge of all tendering and quotations. The work is concerned with electrical products in the heavy field, mainly on transmission and sub-stations. Applicants must have experience in these fields and be capable of analysing tendering documents and preparing estimates and quotations, as well as organising a department. Initial salary up to £1,500 with excellent prospects.

Reference Number 142.

Please reply in confidence quoting reference number to:—

Robert Clive (Consultants) Limited

Appointment Consultants,

27, ALBEMARLE STREET, LONDON, W.1.

(T 137)

BRITISH Engine Boiler and Electrical Insurance Co. Ltd., 98 West George St, Glasgow C.2. ELECTRICAL SURVEYOR required for Scotland. Permanent position carrying progressive salary scale £825/£1,225 with non-contributory pension. Candidates aged 26 to 32, with H.N.C. in Electrical Engineering or Grad. I.E.E. and with apprenticeship in manufacture or repair of electrical machinery, are invited to apply stating age, qualifications and experience. (T 154)

DEVELOPMENT ENGINEER required for work on lighting equipment, including circuits and control gear. Minimum qualifications: H.N.C. or equivalent. Staff Pension Scheme.—Box No. 8107, Electrical Times. (T 122)

DEVELOPMENT ENGINEER AND ASSISTANT, engineer to take charge of a Heater Development Laboratory, after a short initial period. Able to see design through from inception to quantity production with minimum supervision. O.N.C. (Electrical) minimum, but a higher qualification is desirable, together with some years' practical experience of small appliances, and a sound knowledge of elementary physics. Assistant O.N.C. standard. Send details and qualifications, experience, positions held, present salary, etc., to the PERSONNEL MANAGER, E. K. COLE LTD., MALMESBURY, WILTSHIRE. (T 118)

ELECTRICAL ENGINEER required for Glasgow office staff, age 23-28. Applicants (H.N.C. minimum) should have had experience in the manufacture of electrical machines. Progressive salary with non-contributory pension. Applications stating age, nationality, qualifications and experience to British Engine Boiler and Electrical Insurance Co. Ltd., 98 West George St, Glasgow C.2. (T 155)

ELECTRICAL wholesalers have vacancy for ASSISTANT MANAGER of their Sales Order Office, also SALES ORDER CLERK. Only applicants with previous experience in similar business will be considered. Salary: £750/£1,000 according to ability. Full details to Box 8115, Electrical Times. (T 158)

FOREMAN ELECTRICIAN required in the Shrewsbury district. Duties will include supervision of all types of domestic, farming and industrial electrical and wiring installations and organising and controlling of manual labour in this type of work. Conditions of service and salary—£880 per annum, Schedule E, Grade 1—in accordance with N.J.I.C. Agreement. Apply, by letter, within ten days, stating age, experience and present position to Mr W. Winwood, Sub-Area Manager, Midlands Electricity Board, Spring Gardens, Ditherington, Shrewsbury. (T 132)

BRITISH RAILWAYS

EASTERN REGION ELECTRIFIED LINES
LONDON AREA
ASSISTANT CONTROL ROOM OPERATORS

required

Under Railway Electrical Conditions to assist in the operation of the Electrical Control Room at Romford. Applicants should have served a recognised apprenticeship and possess knowledge of E.H.T. and L.T. distribution systems, isolation procedure and safety precautions. Shift working involved. Rate of pay: £12 2s per week of 44 hours, plus shift allowance 33s. Enhanced pay for overtime and Sunday duty. Applicants required to undergo medical examination. Certain free and reduced rate rail travel facilities. Pension and sick pay schemes. Prospects of promotion. Apply in writing, giving age, apprenticeship and experience to the Electric Traction Engineer (London Area), British Railways, Eastern Region, off Ley St, Ilford, Essex.

(T 129)

DESIGNERS
for
ELLISON SWITCHGEAR

If you have design experience with the gear mentioned below, there may be a permanent position for you on our design staff. We require:

SENIOR DESIGNER
for
HIGH TENSION OIL-CIRCUIT-BREAKERS UP TO 11 kV

SENIOR DESIGNER
for
LOW TENSION OIL/AIR-BREAK CIRCUIT-BREAKERS

These appointments offer many advantages, including a non-contributory pension scheme and the usual sports and social facilities.

Write to our **Personnel Manager** at **George Ellison Ltd., Perry Barr, Birmingham 22B.**

(T 130)

JOINTERS (E.H.T.) and JOINTERS required. Present rates of pay: 5s 6½d and 5s 4½d per hour. Previous experience essential. N.J.I.C. Conditions, including 42-hour, five-day week, holiday and sick pay schemes, optional superannuation scheme. Apply by letter to District Manager, Midlands Electricity Board, 296-8 High St, West Bromwich, Staffs. (T 127)

DORMAN LONG (STEEL) LIMITED
CONTROL ENGINEER
in Works Power Station

Applications are invited for the above Staff Appointment which involves working a 42-hour week, shift rota.

Applicants should have practical experience of operation of alternators and H.V. switchgear.

Apply in writing giving full details of experience and qualifications to: **Dorman Long (Steel) Ltd., Employment Office, Cleveland Wks, South Bank, Middlesbrough, Yorks.**

(T 156)

OVERHEAD LINESMEN required with experience. Good prospects and wages. —Box 8103, Electrical Times. (T 116)

OVERHEAD LINE SURVEYOR required with experience of obtaining wayleaves. Good salary and prospects.—Box No. 8105, Electrical Times. (T 117)

DRAUGHTSMEN
for
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We have vacancies in our modern drawing office for staff who have sufficient experience to fill the following positions:

SENIOR CONTRACTS DRAUGHTSMAN
for
LOW TENSION OIL-CIRCUIT-BREAKER SWITCHBOARDS

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JUNIOR DRAUGHTSMEN

Advantages include non-contributory pension scheme, good canteen and the usual sports, social and welfare facilities. Apply: **Personnel Manager, George Ellison Ltd., Perry Barr, Birmingham 22B.**

(T 131)

TRINIDAD AND TOBAGO ELECTRICITY COMMISSION

West Indian Engineers who are interested in careers with the Trinidad and Tobago Electricity Commission are invited to write to the Secretary, P.O. Box 121, Port of Spain, Trinidad, West Indies. There are good opportunities for young West Indian Nationals with degrees in Electrical Engineering or who hold Higher National Certificates in Electrical Engineering or who are Graduate Members of the Institution of Electrical Engineers. Commencing salary £1,050 per annum. Experience not necessary, but candidates *must* be qualified. (T 47)

GPO

A FIRST-CLASS JOB IN THE G.P.O.

Men between the ages of 20—35 are required to work in Central London on installing and maintaining telephone apparatus and transmission equipment. Older men, up to the age of 45, will be accepted if they have the experience which is particularly suitable.

Commencing pay is £9 16s per week rising to £12 2s.

Men who show ability to progress will be given every opportunity to qualify for Technical Officer posts on which the salary is £600 a year rising to £850. Further promotion is available.

Apply in writing stating age and experience to:

Chief Regional Engineer (Ref. S/D2A(X2)), London Telecommunications Region, Waterloo Bridge House, Waterloo Road, London, S.E.1. (T 14)

TECHNICAL SALES REPRESENTATIVE required by leading Industrial Lighting Fittings Manufacturers for East London, age 24-28, H.N.C. preferred, outside sales experience not essential. Salary, commission and expenses, car provided.

Apply in writing to F. W. Thorpe Ltd., Welby Rd, Hall Green, Birmingham. (T 85)

LARGE ELECTRICAL CONTRACTORS

require

CONTRACTS MANAGER

The successful applicant will be responsible for all aspects of Contract Organisation and Execution and should have drive, initiative and a thorough training in Electrical Contracting.

A salary of between £1,500 and £1,700 is envisaged and a car or car allowance will be provided. This is a superannuated position in a Company having a large expansion programme before them.

Applications, which will be treated in the strictest confidence, should be in writing, stating age, experience, qualifications and present salary, to: Box No. 8101, Electrical Times.

(T 113)

WORK WANTED

A.C. and D.C. MOTOR REWINDS and REPAIRS. Prompt service, fully guaranteed. Edgware 5566 (4 lines).—Service Electric Co. Ltd., Stanmore, Middx. (T 2)

WANTED

WANTED for prompt cash, ferrous and non-ferrous SCRAP: also plant for dismantling. Buyers of second-hand machinery and plant for re-use.—W. and H. Cooper Ltd., 17 Brady St, Bethnal Green, E.1. (T 1)

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ELECTRICAL EXPORT SALES ENGINEER, 33 years, widely experienced in selling power equipments in Near and Middle Eastern, Arabian and African markets; with outstanding sales evidence wants responsible appointment as sales representative or permanent appointment abroad with reputable export firm or manufacturers. Can guarantee orders. Reply to the editor under No. 8113, Electrical Times. (T 141)

TECHNICAL REPRESENTATION in S.E. offered by qualified Electrical Engineer on free-lance or part-time basis; own office, transport, etc.—Box No. 8111, Electrical Times. (T 125)

FOR SALE

A.C. and D.C. SLOTMETERS: Time Switches and Quarterly Meters. Single and polyphase, 2½-100 amps. Tested and guaranteed 2 years. Television and Billiards Meters. — Tradex Meter Co., Surbiton. Elmbridge 2234/5/6. (T 9)

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A.A. ELECTRICAL CO. for A.C.-D.C. MOTORS, switchgear, exhaust fans, hoists, reduction gears, new or reconditioned units.—CHI 5105, 67 Rothschild Rd, W.4. (T 3)

ELECTRIC MOTORS, D.C. and A.C. Motor Generator Sets, Alternators and Dynamos, Diesel Sets, Circuit-breakers, Switchboards, reconditioned and guaranteed. Very large stocks held.—Britannia Manufacturing Co. Ltd., Britannia Walk, N.1. CLErkenwell 5512/3/4. Stores at Chobham, Surrey. (T 7)

HOUSE-SERVICE METERS, A.C. or D.C., quarterly or prepayment.—Universal Electrical, 221 City Rd, London E.C.1. (T 5)

HOUSE-SERVICE METERS, all types can be obtained by return from Selectrics, Dept. E.T., Meter Hse, Factory Row, Castle Circus, Torquay. Phone 7218. (T 8)

PURLEY CHOKES AND BALLASTS. Our 80 W tapped h.p.f. ballast with starter switchgear-holder incorporated is proving itself the most popular unit. Suitable for most fittings, 57s 6d each subject. —F. W. Blanshard Ltd. (Dept. E.T.), Purley, Surrey. Uplands 4818/9. (T 6)

PATENT No. 809705 Illuminated House Numbers, Electric. With £800 stock. Price £3,500 o.n.o.—Box No. 8091, Electrical Times. (T 27)

SECOND-HAND electrical plant can be as good as new if you buy it from specialists. Write for our stock list. Dynamo and Motor Repairs Ltd., North End Rd, Wembley Park, Middx. Telephone: Wembley 3121; Soho Rd, Handsworth, Birmingham. Telephone: Birmingham Northern 0898. (T 10)

BUSINESS OPPORTUNITIES

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For further particulars apply Box No. 8089, Electrical Times. (T 26)

PATENTS

THE Proprietor of Patent No. 658869 for "Finger Type Circuit Regulator" desires to secure commercial exploitation by licence or otherwise in the United Kingdom. Replies to Haseltine Lake and Co., 28 Southampton Bldgs, Chancery La, London W.C.2. (T 119)

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(T 124)

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Tables cover a.c. motors, d.c. machines, a.c. generators, rotary converters, bearings, transformers, mercury arc rectifiers, starters and switchgear and fluorescent lighting.

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based on the HOLGER NIELSEN method of resuscitation.
Illustrated to ensure simplicity

Prepared by
Dr. P. Pringle, LL.B., B.Sc.(Econ.) M.R.C.S., L.R.C.P. D.I.H.

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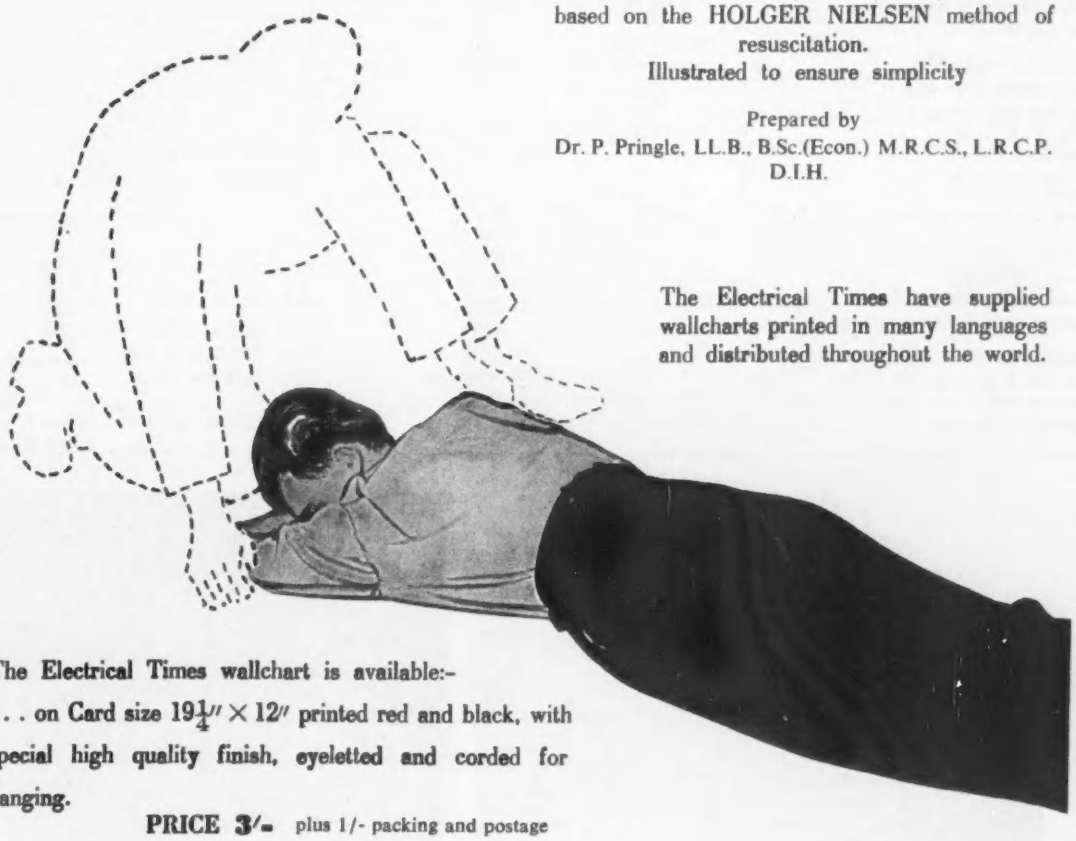

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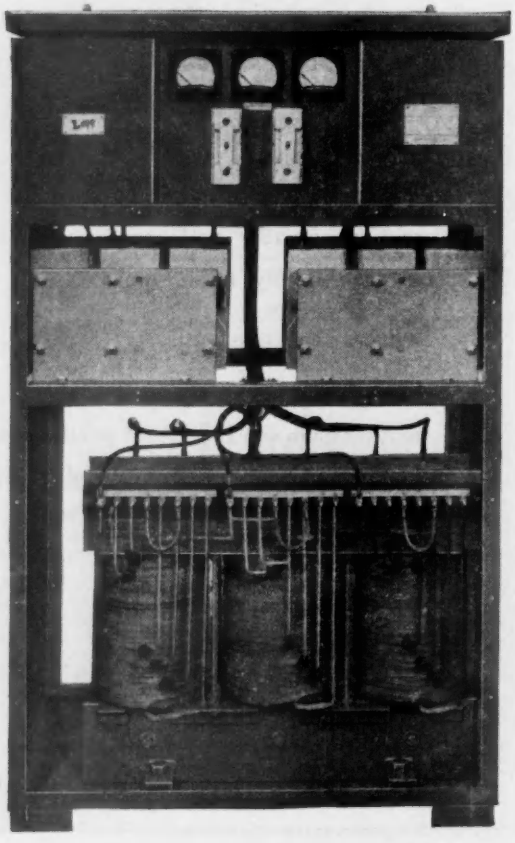

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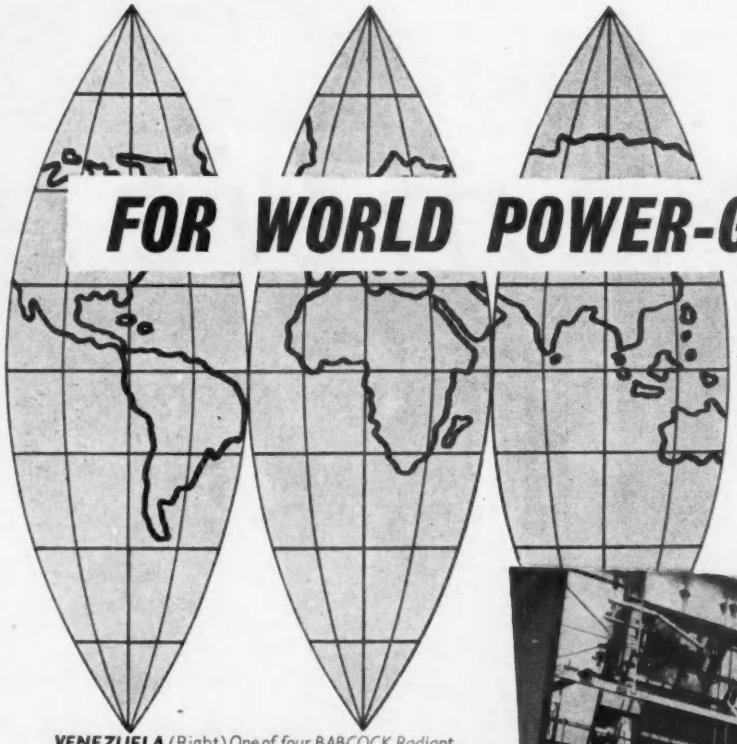

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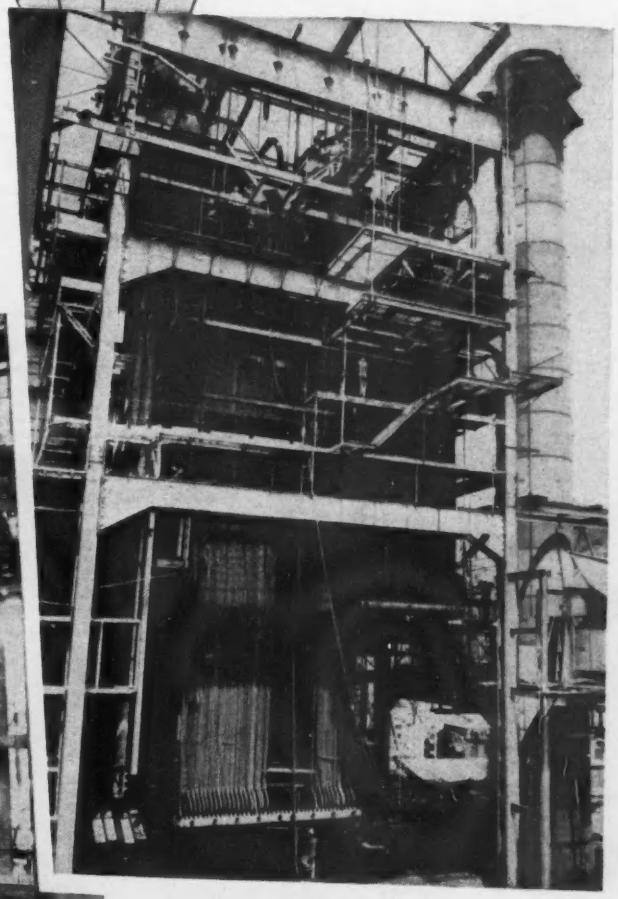
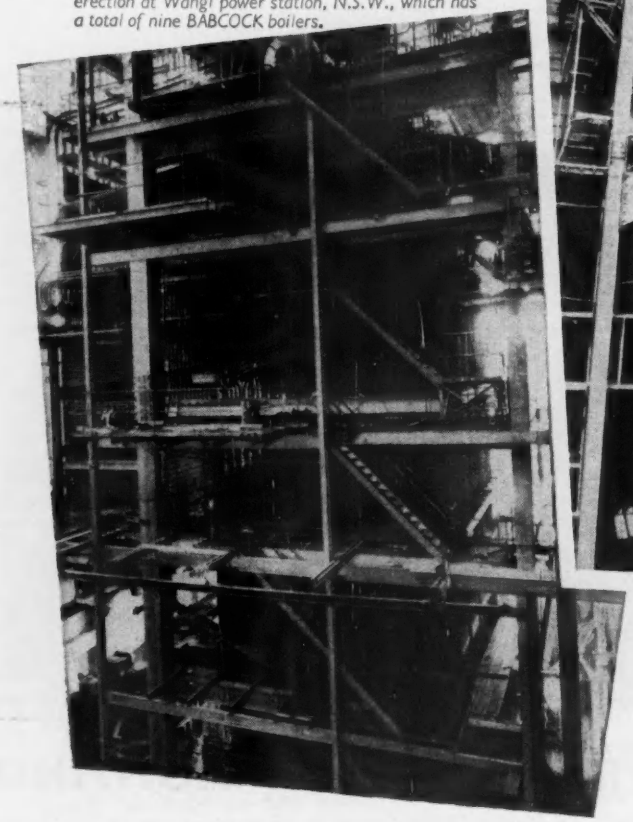


VENEZUELA (Right) *One of four BABCOCK Radiant boilers, natural-gas and oil fired, each rated at 550,000 lb./hr.; during erection for La Electricidad de Caracas. (Consulting Engineers: Sofina)*

AUSTRALIA (Below) *One of three BABCOCK Radiant boilers, each rated at 550,000 lb./hr.; during erection at Wangi power station, N.S.W., which has a total of nine BABCOCK boilers.*



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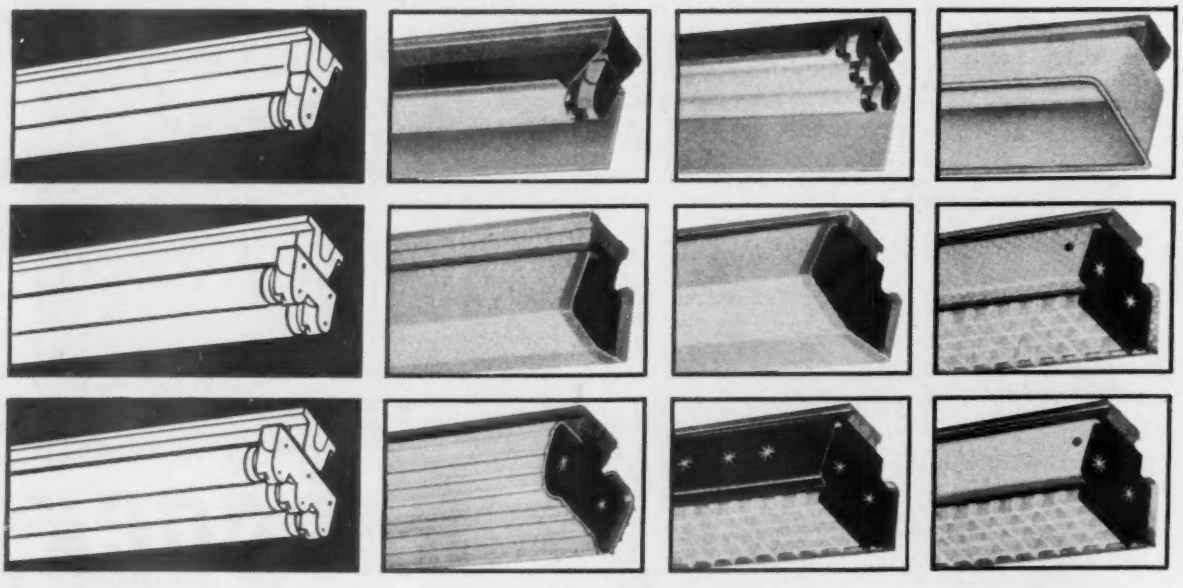

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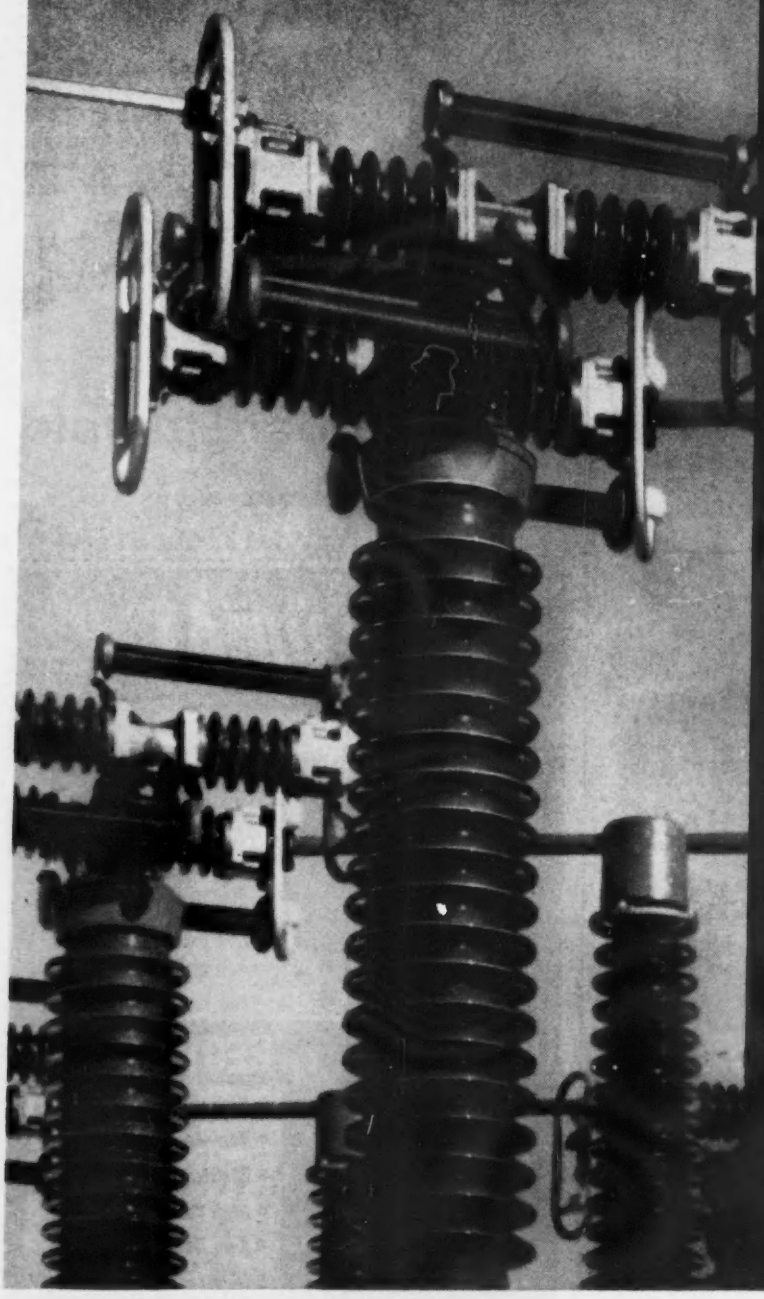

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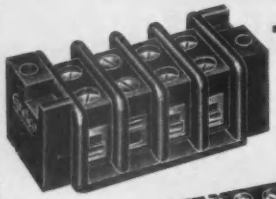

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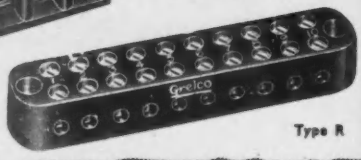

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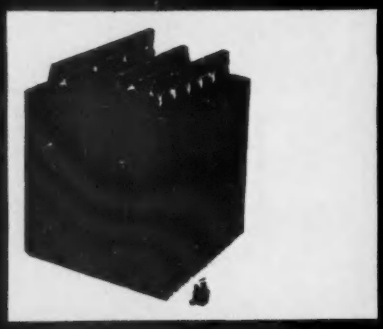

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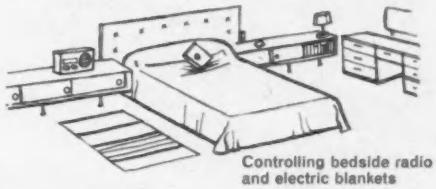

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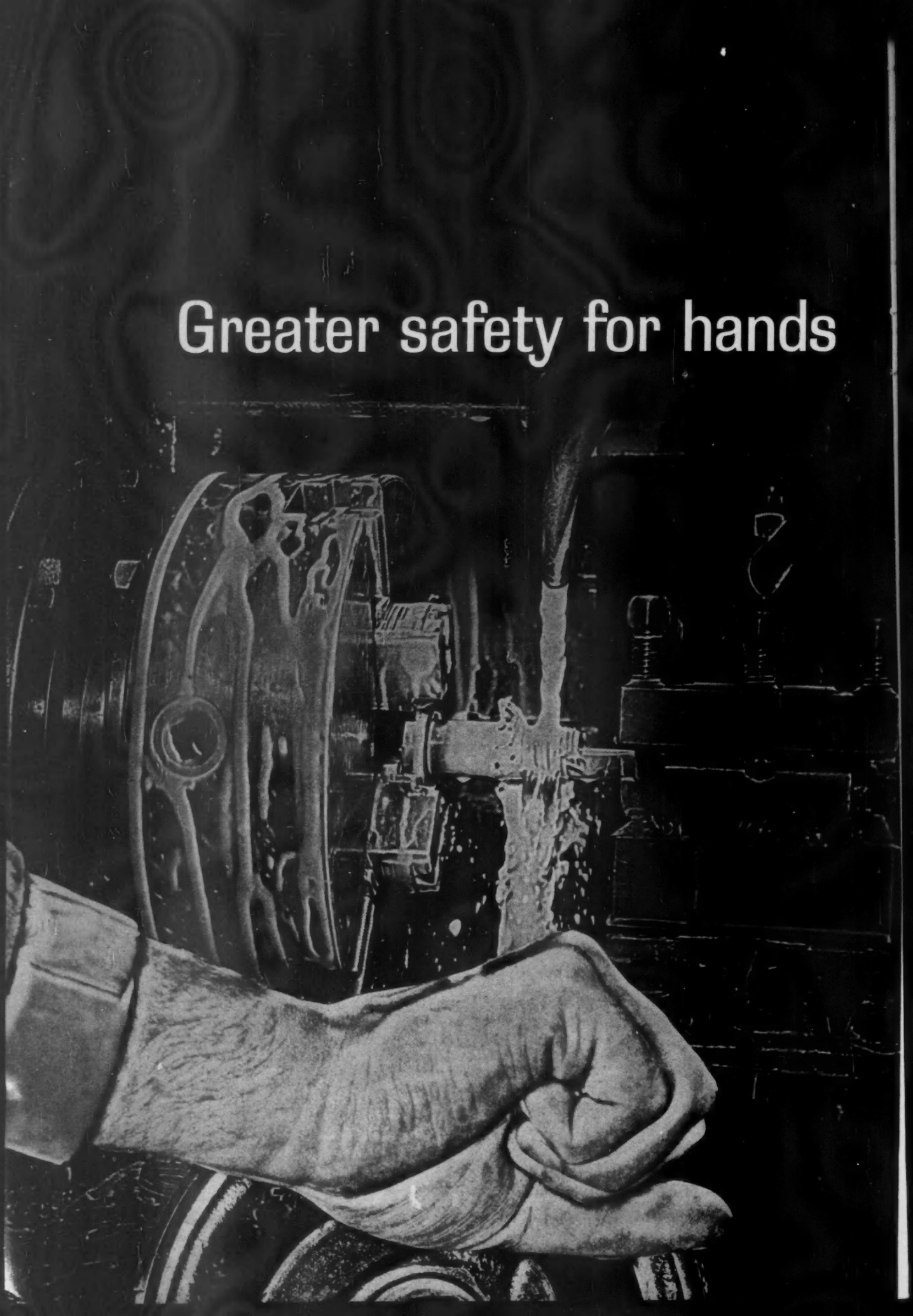

With new Shell Dromus Oils

Most modern soluble cutting oils contain phenolic compounds used as coupling agents between the oil and the emulsifier, for better blending and easier mixing. These phenolic compounds can cause skin irritation, especially where modern high-speed machines are used and the emulsion can concentrate, through the evaporation of water, above the safety level.

Shell research chemists have been working on this problem, which has been causing some concern to Management. After considerable research, Shell Dromus Oils have been reformulated and these new cutting oils now produce bland emulsions, which considerably reduce the risk of skin trouble to operators.

The real difficulty was to find a new coupling agent to replace the phenolic compounds, and Shell finally used what their chemists know as a higher fatty alcohol complex. This solved one problem, but presented another. The new coupling agent was volatile at the high temperatures normally used in blending processes. Further research found a solution to this problem by designing and installing new plant.

The new Dromus Oils are every bit as efficient as before and cost no more. They put Management in the welcome position of being able to minimise working hazards at no extra cost. And machine men need no longer be so worried about skin troubles.

The moral of the story is that Shell research is supremely applicational. The centre at Thornton is always ready to work with even the most specialised sectors of industry to produce the right oil for the job. If you and your organization have any major lubricating problems, it pays to get in touch with your local supplier of Shell Industrial Lubricants.

The Research Story

Shell chemists in the U.K., in Holland and in the U.S.A., prepared and examined hundreds of experimental soluble oils, and established that certain combinations of fatty alcohols could be used in place of phenolic compounds with no loss of efficiency. They set to work to discover the best combination and developed a higher fatty alcohol complex which fitted exactly. Then they realised that to blend this new coupling agent into soluble oils would require special plant and new blending techniques.

Exhaustive testing of blend stability, emulsion stability, anti-corrosion and machining properties led to selection of the most promising blends. A pilot plant was set up to produce batches of these for use in field trials.

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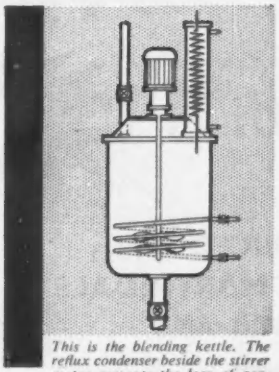

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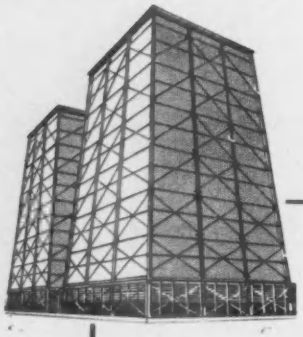

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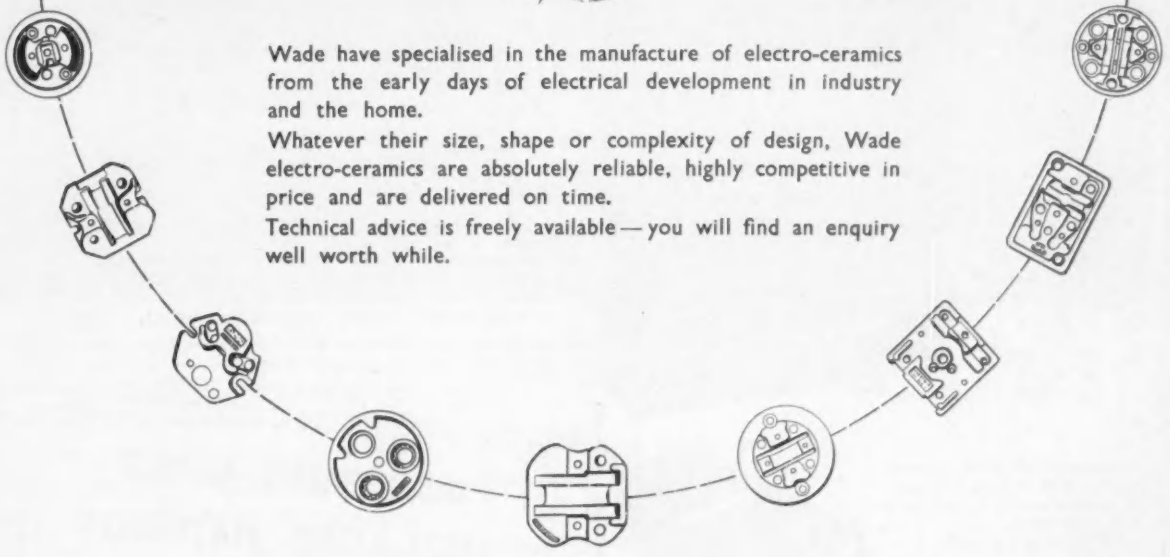

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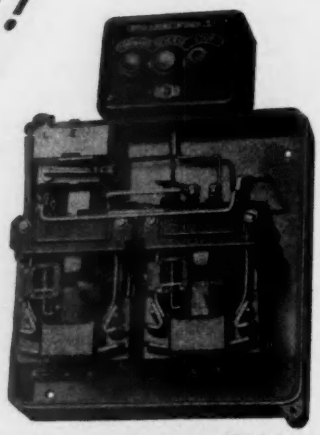

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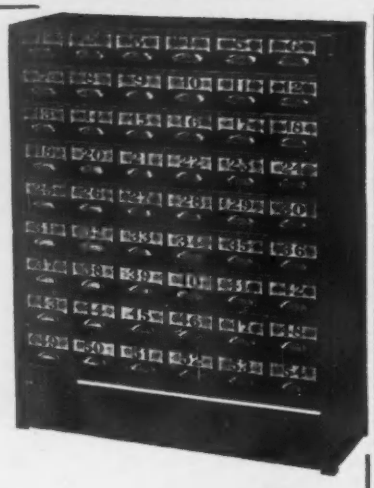

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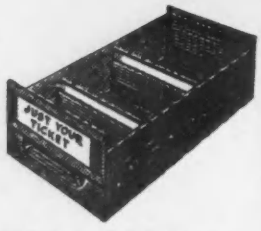

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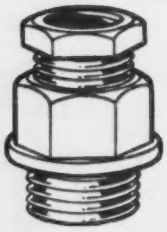

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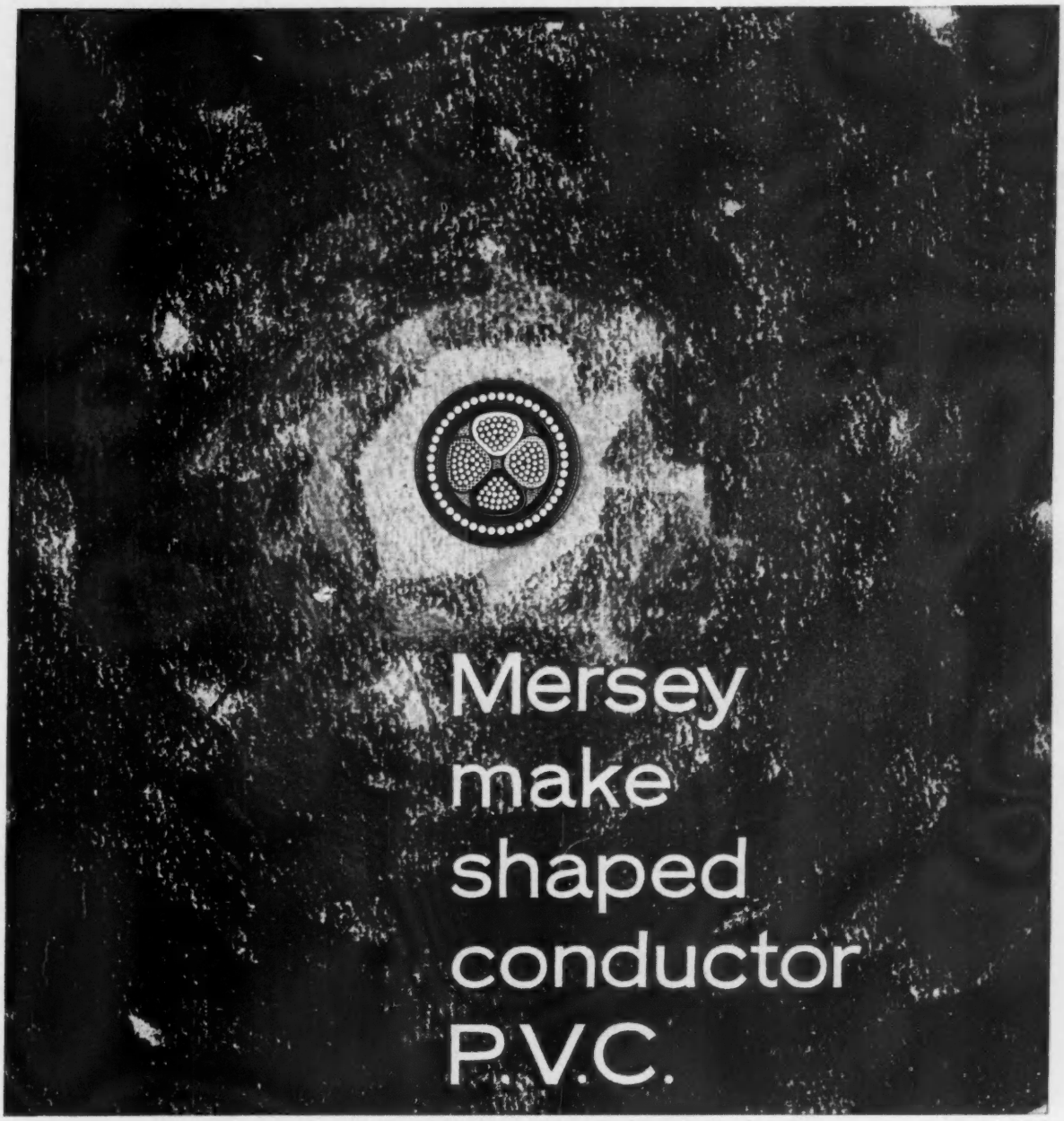

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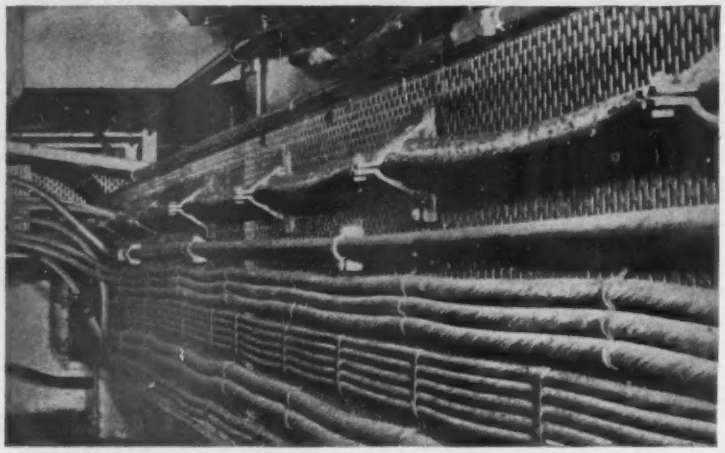

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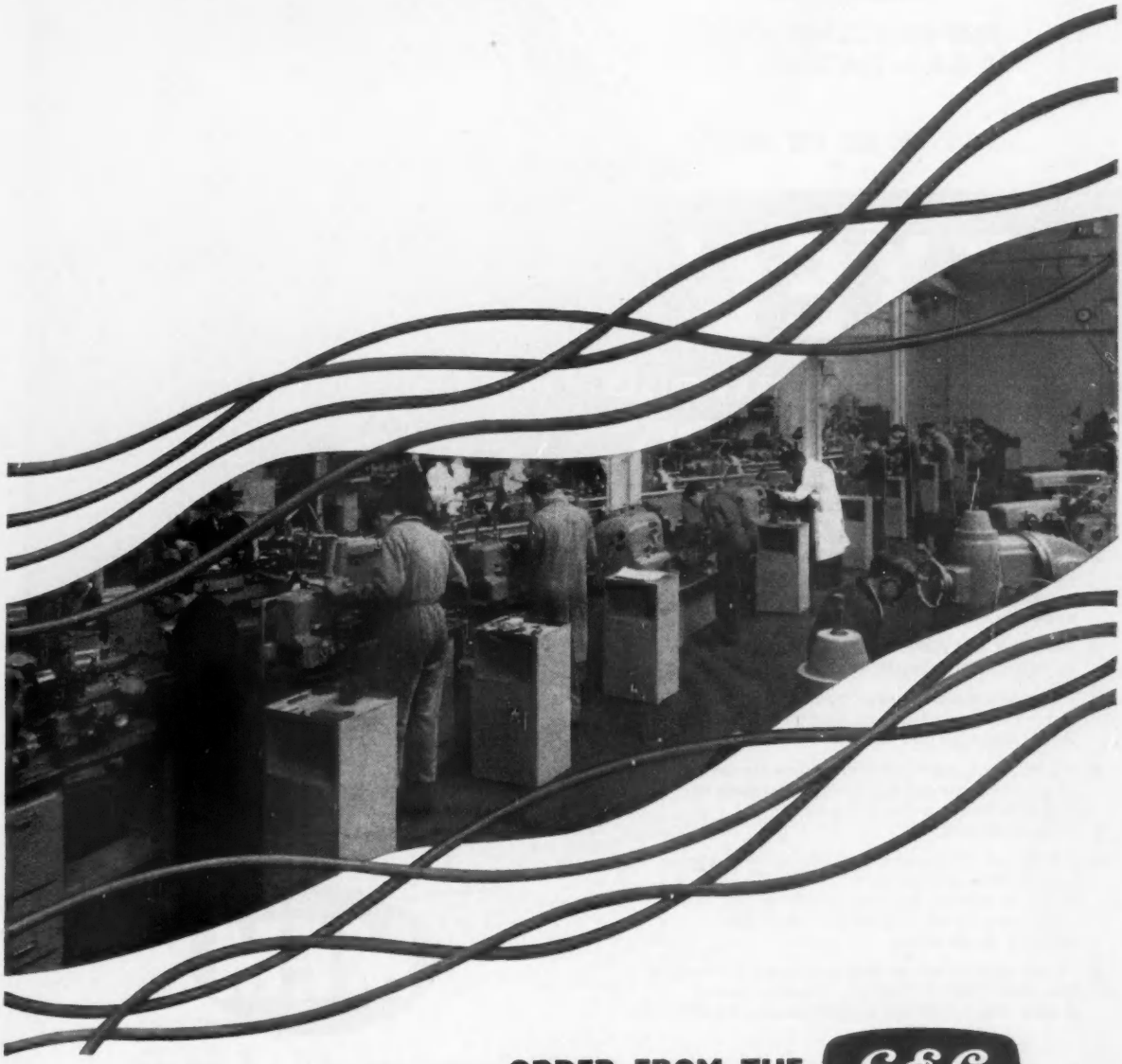

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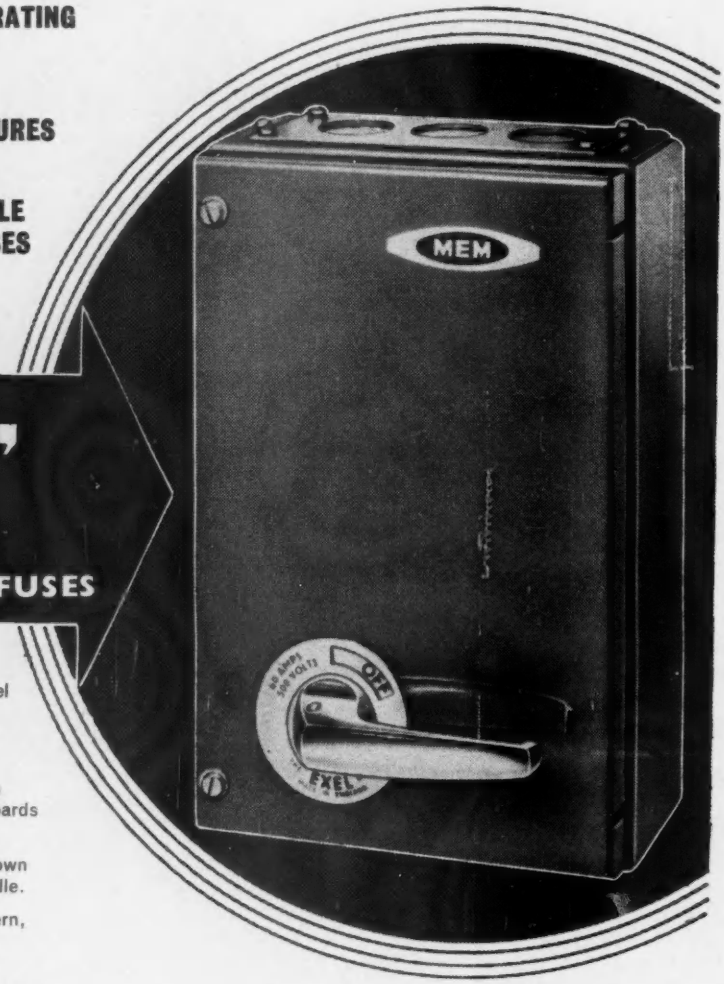

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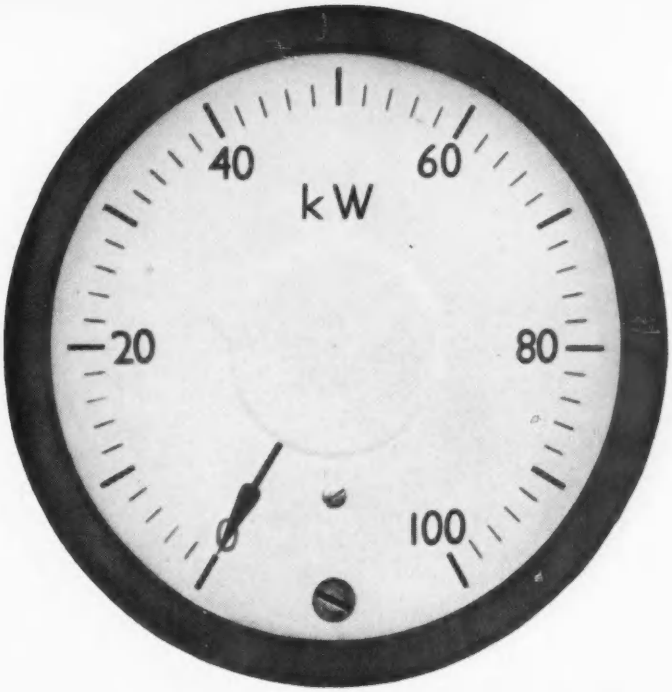
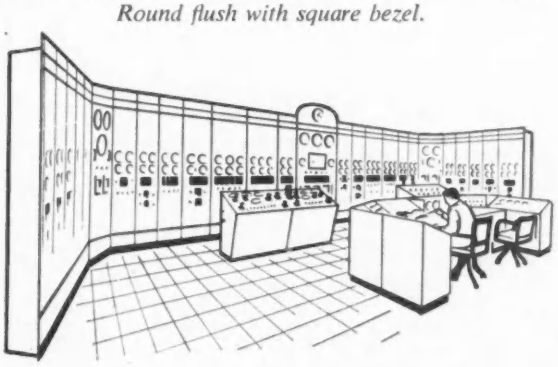


Long-range readability
WITH
AEI instruments

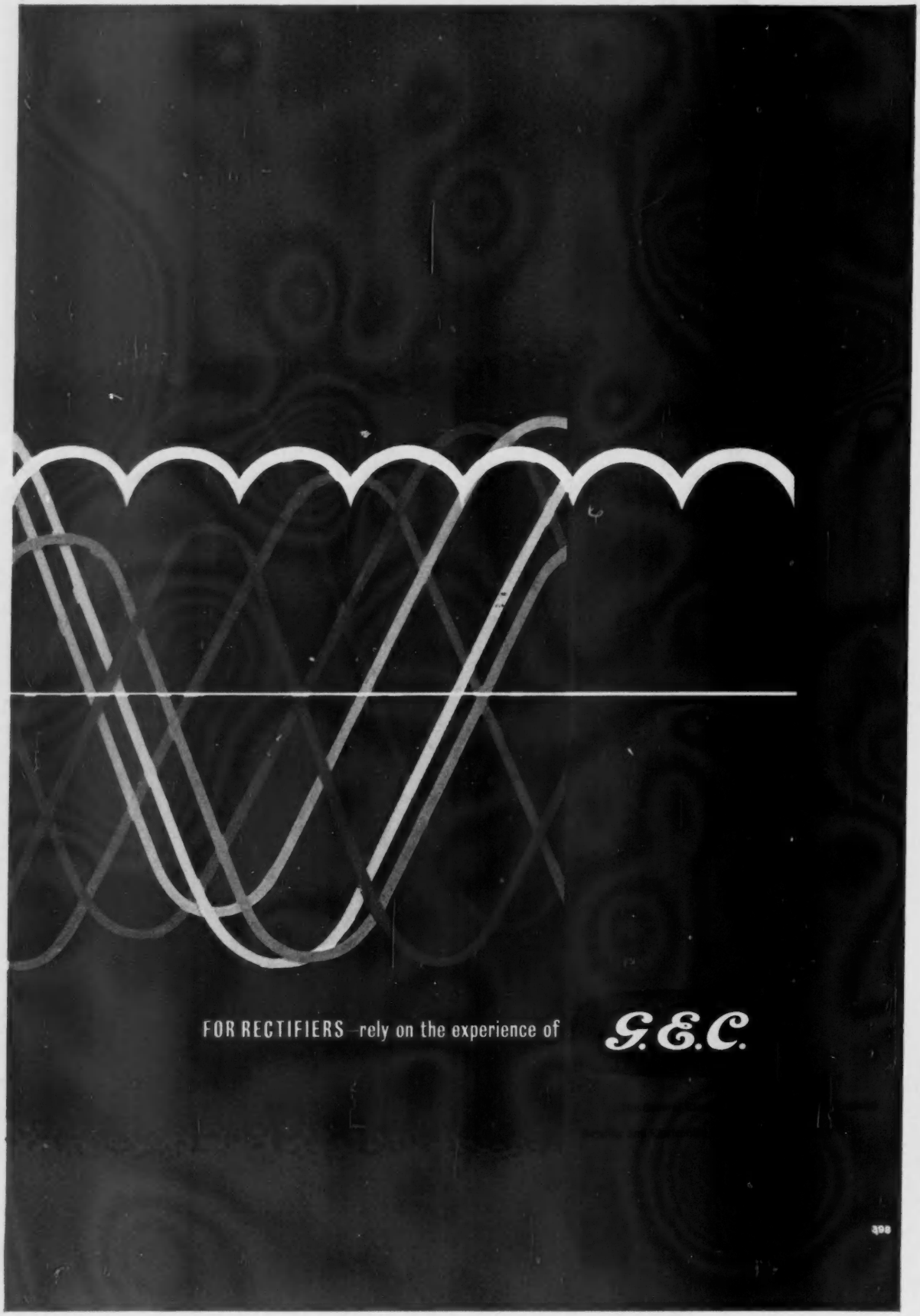
With its modern scale presentation, the AEI FC2 Wattmeter can be accurately read from a distance of many feet. It is typical of a wide range of instruments from AEI, including voltmeters, ammeters, power factor indicators and synchroscopes, developed for ease and reliability of use in modern power stations.

DIAL SIZES: *4 in., 6 in., and 8 in.*
PATTERNS: *Round projecting. Round flush (as illustrated). Round flush with square bezel.*



Enquiries to the address below or to your local AEI Office.

AEI Associated Electrical Industries Ltd.
Instrumentation Division Instrument and Meter Department
TRAFFORD PARK, MANCHESTER, 17


FOR RECTIFIERS rely on the experience of G.E.C.